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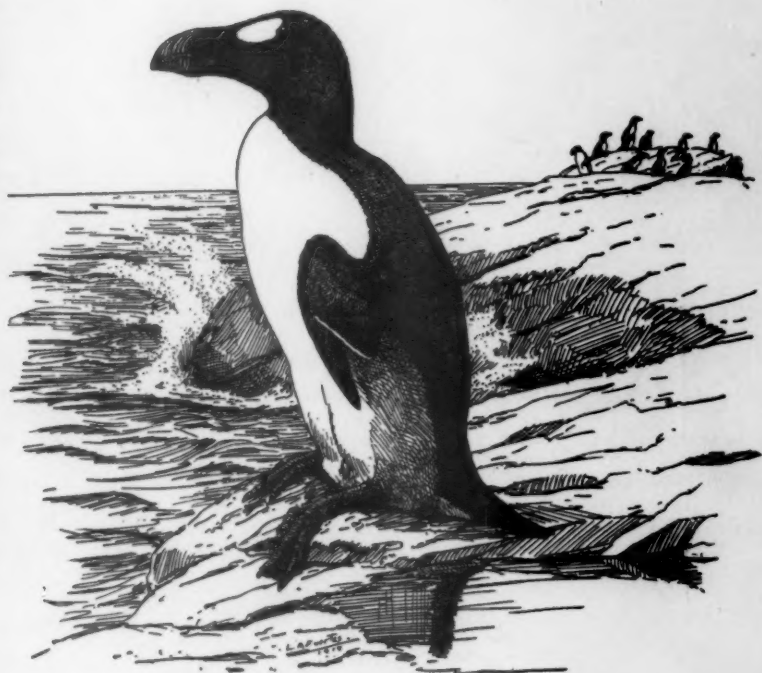
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PIED-BILLED GREBE ARRIVING AT THE NEST



PIED-BILLED GREBE UNCOVERING ITS EGGS



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NESTING HABITS OF THE PIED-BILLED GREBE

BY MURL DEUSING

Plates 11, 12

THIS study of the nesting habits of the Pied-billed Grebe (*Podilymbus podiceps podiceps*) was made by Peter Stieb, Carl Kinzel, and the author during the summer of 1938 at Lake Koshkonong, Wisconsin. The nest, found on July 10 (rather late for our nesting season), contained two eggs. It was of the regular floating type made up of wet and decaying plant materials mixed with some green stems of arrowheads. The nest was floating in two feet of water about forty feet out from the cattail-lined shore of an old swampy slough. It was surrounded by a thick growth of arrowheads. On July 17 we returned to find seven eggs in the nest. On that day we built a blind six feet from the nest for observations and photography. From July 17 to August 6 we spent forty-two hours of observation in the blind. These observations were made on twelve different days in periods ranging from one to seven hours in length.

On July 31 the first eggs hatched, one in the forenoon and one in the afternoon. Depending upon whether the first egg was laid on July 8 or July 9, the incubation period for these two eggs was twenty-one to twenty-three days. The third egg hatched on August 2. We were unable to return to the nest again until August 6, when we found two eggs remaining in the nest; the others apparently had hatched. I broke open one of these eggs and found a living chick inside; if given time there is no doubt that it would have hatched.

In our observation we found no truth in the theory that the grebe trusts to the warmth generated by decaying vegetation for the incubation of the eggs. After eliminating those periods of time during which the grebe was disturbed or alarmed, and counting only the periods during which the birds were working under normal conditions, we found that the eggs were left unattended on an average of only eight minutes at a time with the longest

period of absence thirteen minutes. Both male and female incubated. The female incubated from twenty-four to fifty-three minutes at a sitting with an average of forty minutes. The male incubated from nine to sixty-five minutes at a sitting with an average of twenty-nine minutes. The male and female, with one or two exceptions, alternated at the nest, taking turns at incubation. On only a few occasions did we see both of the adults at the nest at the same time. We could identify the male from the female by both a larger size and a peculiar dark mark on the bill near the eye of the male. Several times we noticed that the male and female would touch bills as they passed each other in exchanging places at the nest.

The grebes did not seem to have a favorite approach to the nest. They came to the nest from any direction, though of course they used the side opposite the blind most freely. In coming to the nest, the grebe would generally make an underwater approach, rising next to the nest. Often it would look about quickly then dive again to come up on the other side of the nest or in the midst of the arrowheads nearby. After a few minutes of appearing and reappearing about the nest, the grebe would swim up to the nest and touch it with its breast. Then backing up a few inches, the grebe would work its legs vigorously for a second or two, and then hop up on the edge of the nest. Several times the grebe skipped all of these preliminaries and without any previous reconnoitering popped out of the water a foot or two from the nest, and landed lightly on its edge.

Once on the edge of the nest the grebe would stand erect, and after a few preliminary pokes at the nest material it would begin to sidestep around the rim of the nest, removing the covering from the eggs with quick, short jerks of the bill. From one to two circuits of the nest were usually necessary to remove all of the vegetation from the eggs. With the eggs uncovered, the grebe would set its legs one on each side of the nest, and with a business-like wiggle of its body flop forward over the eggs. Occasionally the grebe would not be satisfied but would rear up and remove a strand or two of vegetation that had been overlooked, or would poke at the nest material along the edge of the clutch of eggs. In doing this, an egg or two might be turned slightly, but there was never any rolling or shifting of the eggs as is done by many of the other marsh birds. Shortly after settling on the eggs, the grebe would frequently take the loose vegetation that had recently covered the eggs and pack and press it about the sides of its breast. Once settled, the grebes would often keep their position for the full length of the period of incubation. Occasionally they would yawn vigorously, and then fall asleep on the nest, with bill resting on the breast. The slightest noise, however, would wake them. Time was also passed by preening both the breast and the back feathers and poking at the rim of the nest. All of this was done without moving the position over the eggs.

On hot days the grebes were much more restless at the nest than on cool days. They would rise up now and then to readjust themselves. Sometimes they would stretch the neck way over the rim of the nest and take a drink of water without leaving their position on the eggs. With each swallow the grebe would throw its head back, wiggling its throat and bill much like a chicken when it drinks. When the sun shone directly on them they would pant very rapidly, and often they would produce a curious motion of the wings. This wing movement was done while the grebe was settled in a natural position on the eggs. It consisted of raising and lowering the wings, one at a time alternately, about one-half inch above the back. This shifting of the wings was done rapidly with the rhythm of marching feet. On one day we saw an even more curious wing movement. Standing very erect on the nest, the grebe began to fan its wings, holding them directly out backward with a peculiar quivering motion so rapid that the wings became a blur. On the motion-picture screen the effect is much like that of the wing movements of a drumming grouse. However, the grebe's wings made absolutely no sound. We saw this action a total of six times, all during a single day. Five times the grebe performed the action just after arrival at the nest, and while the eggs were still covered. Once the grebe had been incubating for a period of twenty-two minutes when it suddenly stood up and fanned its wings. The day upon which this peculiar wing movement occurred was a very hot one, and it is possible that the action may have helped to cool the eggs. However, on several other equally hot days the grebes did not perform in this way at all. We are at a loss to explain this curious action.

The grebes had a variety of calls and notes about the nest. The *wup, pup, pup, pup, kaow, kaow, kaoo, kaoo* call of the mating season was heard irregularly all through the nesting season. This call was generally given by the grebes while off the nest. Twice, however, we saw the male grebe give the *wup, pup, pup, pup, pup* call from the nest. In giving the call, the bird stretched its head forward and upward, and with throat and cheeks puffed out full and round delivered the call. Often the male would call *wup, pup, pup, pup, kaow, kaow, kaoo* from out in the marsh, and would be answered by the female on the nest with a soft *whut, hu, hu, hu, hut*. The grebes also had a very striking call which they seemed to deliver when in a state of alarm. This call sounded very much like the air compressor of a street car pumping up, but was more resonant. In words it might be described: *hu, hu, hu, hu, hu, hu, hu*. This steady rhythmical calling might be kept up for some seconds.

On three occasions we saw the grebe add material to the nest, always inserting it into the rim of the nest. On one day we saw the female spend about ten minutes in gathering brown, partly decayed plant material from

the bottom and inserting it in the rim of the nest. Much of this came from the area directly around the nest. Green materials, obtained at some distance from the nest, were inserted into it on two other occasions. All the building operations we observed were done by the female.

Upon leaving the nest the grebes reversed the action of covering the eggs. Standing up erect, the grebe would sidestep around the edge of the nest, and with quick, short thrusts of the bill cover the eggs. The grebes seldom left the eggs uncovered. Three times, however, we saw them leave their eggs uncovered while working under normal conditions. Twice the male and female were exchanging places at the nest. On one of these occasions the male slipped off the nest, meeting the female coming toward it. They touched bills, then the male dove and the female hopped on to the nest and settled on the eggs. Another time the female left the nest with the eggs uncovered. Both birds could be heard a few minutes later back in the arrowheads. Eight minutes later, the male came up to the nest and took his place over the eggs. On a third occasion the male left the nest without covering the eggs as the female approached. Both birds dove together. Five minutes later the female appeared behind the nest. She poked at the nest rim several times and then dove. Five minutes after the appearance of the female, the male came back to the nest, covered the eggs thoroughly, and then dove out of sight.

When alarmed, the grebes could cover their eggs very rapidly. The first time we started to take motion pictures, the grebe became alarmed at the noise of the camera. Jerking upright the grebe covered the eggs with three or four short thrusts of the bill. Then slipping off the nest backward it disappeared. The whole performance was over in less than five seconds. The covering over the eggs, however, was not complete, and the eggs showed through. Five minutes later, the grebe was back at the nest. It hopped on to the nest, covered the eggs more thoroughly, then dove. Often when alarmed the grebes would quickly cover the eggs and then sit down on top of the covered eggs. If no danger developed the grebe would uncover the eggs again and continue the incubation.

When thoroughly frightened the grebes left the nest without covering the eggs. Once, without warning, I stuck my head out of the blind. The grebe on the nest gave me one startled, wild look and slipped off the nest without covering the eggs. I left the blind immediately but returned three minutes later. The grebe had returned and covered the eggs in my absence. Natural noises in the marsh, even if they were loud and startling, never frightened the grebes. Carp jumping and splashing so close to the nest that they startled us in the blind, did not cause any apprehension on the part of the grebes. Noises from the blind, however small, frequently caused alarm. Even visits to another blind four hundred feet away from the



PIED-BILLED GREBE INCUBATING



PIED-BILLED GREBE SHAKING YOUNG OFF ITS BACK

grebe's nest by other members of our party would cause the grebe to leave the nest and investigate.

Turtles and the Long-billed Marsh Wren came to the nest in the absence of the grebes. Once a Marsh Wren came down to the nest and began to hop around catching insects. Finally it began to spread its wings out in a quivering fashion and flutter around the nest in a mating display for a female sitting on top of the blind. In the meantime one of the grebes appeared in the arrowheads back of the nest. It sat there for several minutes watching the wren intently. When the wren began to flutter about on the nest the grebe dove and rose up suddenly between the blind and the nest. The wren flew quickly away. The grebe sank slowly and swam away. Another time while one of the grebes was incubating the eggs an eight-inch turtle came swimming up from behind the grebe and placed its forelegs on the rim of the nest. The moment the turtle touched the nest, the grebe whirled around and struck at the turtle, which quickly disappeared.

With the hatching of the young the habits of incubation changed decidedly. The female did almost all of the incubating after the young began to hatch. With two young in the nest the average period of incubation dropped to seventeen minutes. Intervals between sittings ranged from sixteen minutes to several hours. On the day the third young hatched, the female came to incubate only once for a period of six minutes. The male did not appear at the nest after the day the first young had hatched. No adequate observations were made after the third young hatched. With the hatching of the first two young, the grebes became careless about covering the eggs, and about half of the time they failed to cover them. With the hatching of the third young the eggs remained uncovered all day.

One thing that amazed us was the speed with which the chicks freed themselves from the eggshells. We found the first young hatched on the morning of July 31. No trace of the eggshell remained at the nest. At 10.30 o'clock that morning the remaining six eggs were carefully checked. There was no evidence of pipping—no cracks appeared on any of the eggshells. Yet at two o'clock the observer in the blind was startled to see a young grebe stick its head out of the covering of vegetation over the eggs, and then wiggle itself free. When the observer left the blind forty-five minutes later he checked the nest again and found five eggs remaining and the empty eggshell of the sixth. The young grebe had freed itself from the eggshell in three and one-half hours, and without any previous cracking or pipping of the eggshell. With the hatching of the third young we saw the female remove the eggshell from the nest. Taking it in her bill she swam about ten feet away, then dove to the bottom with it.

We had many opportunities to see the young crawl up on the backs of the adults. The young always crawled up alongside of the tail and up under one

of the wings. Often they would crawl far forward under the feathers and finally their little black and white striped heads would appear out of the hollow of the adult's back just behind the neck. If one young gained the back (and this seemed to be the coveted spot) the second young to crawl upon the back remained under a wing. We never saw more than two young upon an adult's back at one time, but there is no doubt that a third young could have been accommodated under the other wing. The struggle to get up on the back was a violent one for the new-born young. It was always accompanied with much wiggling and scrambling, and often the young would rest when halfway up, its legs dangling out from under the adult's wing in a ludicrous fashion. The young scrambled up on the back of the adult both from the nest and from the water. When the young wanted to get up on the back of the adult while swimming in the water, it would swim up to the old bird and begin to poke at the breast or sides. The adult would then deftly swing around and present its tail to the young. With much pushing and wiggling the young one would scramble up under the wing. Sometimes the adults would dive with a young one under the wing. Often the adult would carry the young ones to the nest under the wings. However, if the old birds stood erect to uncover the eggs, the young would frequently slide out from under the wings. Once we saw the female shake out the young from her back after she had settled on the eggs, and at another time the young were dislodged when the female preened her back and wing feathers while on the nest.

While much of the feeding was done back in the arrowheads and out of our range of vision, we were fortunate enough to see several feedings at the nest. Most of the time the young were fed on dragonfly nymphs. Some of these were almost as long as the young grebes, and though they tried mightily the young could not manage to swallow the large nymphs. In this case the old grebe took the nymph from the young and shook and threshed it under water until the insect broke in several parts, whereupon the young swallowed the parts greedily. Once we saw an unusual feeding operation. A young one climbed up under the wing of the adult in the usual fashion. The old grebe sank out of sight, but within a few seconds rose to the surface again with its back covered with the lace-like stems of the bladderwort. The young one pushed its head out of the back and then the old grebe, turning its head backward, began to pick small insects out of the mass of bladderwort and feed them to the young.

The young grebes had a bright metallic *chip* with which they called incessantly during the absence of the adults. When they were alarmed, however, they remained very silent, and if we approached the nest they frequently dove off the edge and hid in the arrowheads nearby. After an alarm the adult grebe would call her family together with a soft grunting *hu, hu, hu*,

puh. The last note though soft as the others, was sweet and high with a slightly falsetto quality. The young would answer with their sharp, chipping call as they came from their hiding places. We were able to observe for the first three days after the young began to hatch, and then we had to give up the work until the seventh day. On the seventh day we returned for more observations. We saw very little because most of the action took place in the arrowheads. We saw three of the five young that had hatched by that time, following one of the adults. Added to their sharp chip call was an excited *weep, peep, peep*, much like the call of young ducks; and like young ducks they followed the adult constantly, clamoring continually for food. The old grebe dove frequently, but just what the young were being fed we could not determine.

After five of the young were hatched we were unable to carry on any further observations. Of the two remaining eggs in the nest we opened one and found the chick inside alive and well developed. We have no doubt that the egg we left in the nest eventually hatched and the chick joined the rest of the family. Other business forced us to give up our observations after August 6, so that we were unable to follow this interesting family further and get data on their activities after they had left the nest.

The accompanying photographs are by Carl Kinzel and Peter Stieb.

Milwaukee Public Museum

Milwaukee, Wisconsin

MARINE ALGAE IN FOOD OF RHODE ISLAND WATERFOWL

BY JOHN J. LYNCH

THE use of marine algae as food by Rhode Island waterfowl was first noted by the writer in the course of a study of the wintering habits of the Baldpate (*Mareca americana*) in Newport County. Shortly after the investigation was begun, the Greater Scaup (*Nyroca marila*) was observed to take certain species of the green marine algae as food. At that time it was thought that the ducks resorted to the algae as an emergency food. Later, it was found that Black Ducks (*Anas rubripes rubripes* and *A. r. tristis*) fed throughout the season on several species of algae in a brackish marsh in the town of Newport.

TECHNIQUE AND SCOPE OF STUDY

Observations were made in the towns of Newport, Middletown, Portsmouth, Tiverton, and Little Compton, in Newport County, Rhode Island. The greater part of the investigation was carried on from December 1934 to the first of April 1935. Supplementary studies of the Black Duck were made during the summer of 1935, and in January 1936 several trips were made to check previous findings on foods of the Baldpate.

The stomach contents of several Baldpates were examined to determine the identity of the algae taken by that species. These algae were so little reduced by bird digestion, however, that it proved feasible to analyze the droppings of the birds. The bulk of the data contained in this report was obtained in this manner. Percentage composition of the various feedings was arrived at by averaging estimates of the proportion of each species of algae in several low-power microscope-field counts per specimen. Because accurate and detailed measurements could not be made, and because other foods may have been more completely reduced by digestive fluids, the percentages herein given must be considered only suggestive of the relative proportion of foods consumed.

The nomenclature of the algae discussed in this paper follows Taylor's 'Marine Algae of the Northeastern Coast of North America' (5). The identifications of algal material were made at the Rhode Island College of Education, in Providence. Acknowledgment is made of the aid and invaluable suggestions given by Dr. Marion D. Weston, Professor of Botany at the College. A preliminary report on this study was presented in a paper for an extension course in Economic Ornithology, conducted by Dr. Charles Fish, at Brown University.

BALDPATE

Forbush (1) records the Baldpate as wintering sporadically in southern New England. Normally in this region wintering birds feed in the brackish

marshes of Tiverton and Little Compton, where the food plants *Ruppia maritima*, *Zannichellia palustris*, and *Potamogeton pectinatus* are available. The ducks feed at night during the hunting season, leave the feeding marshes at daybreak and spend the day on Easton's, Gardiner's, and St. Mary's Ponds, artificial reservoirs located respectively in the towns of Newport, Middletown, and Portsmouth. Little feeding appears to be done on these ponds, as at that time of year the beds of submerged aquatic vegetation are well beyond reach of surface-feeding ducks. The Baldpates indulge in some amount of pilfering from the American Coot, and glean fragments of *Naias flexilis*, *Potamogeton pusillus*, and *Ceratophyllum demersum* broken loose by diving Scaups and Redheads. Later in the spring the Baldpates show a preference for the new leaves of grasses and they are then found in flooded meadows.

This normal feeding schedule is disrupted by severe cold weather late in winter. The fresh ponds, and frequently the brackish marshes, are frozen over at such times. Probably a certain proportion of the Baldpate population is thus forced to migrate, but a considerable number of the birds move to salt water, usually associating with the Black Ducks, which normally are marine feeders late in winter.

Although during the winter of 1934-35 Baldpates frequented the feeding grounds of the salt-water Black Ducks, the food habits of the two species varied greatly. The Sakonnet River shores at Sachuest Point, Middletown, supported numbers of Black Ducks and Baldpates during that period. The former subsisted on mollusks and crustaceans, which abounded in the rock-weeds (*Fucus* and *Ascophyllum*) between the tide marks; the latter, on the other hand, seemed to prefer the green "sea-lettuce" (*Ulva lactuca*), which was plentiful in the tide pools along the shore. Baldpates were observed in small flocks in another locality—Easton's Point, in Middletown. Field observations indicated that the birds were gleaning drift plants of *Ulva lactuca* and *Enteromorpha intestinalis* from the floating sea wrack. A trickle of fresh water on the shores of this point was a favorite resort of the birds. Doubtless the presence of fresh water has much to do with the location of emergency feeding grounds of the Baldpate, as a third feeding ground was noted at Hazard's Beach, Newport, where tide pools that supported an abundance of marine algae adjoined a small flow of seepage fresh water.

Table 1 shows the species of marine algae found in the winter food of the marine-feeding Baldpate along the Rhode Island coast. In the column marked 'Number of occurrences' is given the number of specimens in which each species of algae was found to occur; the next column shows the number of specimens in which a species formed fifty per cent or more of the contents, and the last the number of specimens in which the entire contents were composed of one species.

Ulva lactuca is seen to be the most important food item taken by the Baldpate in this emergency feeding. *Ulva* is commonly found drifting during the season in which the birds are feeding in salt water, and it is probable that this species is procured from drift rather than from attached growths of the plant. *Monostroma* superficially resembles *Ulva*, and probably is taken indiscriminately with the latter. *Enteromorpha intestinalis* may be obtained from places in which it grows attached to submerged rocks, although, like *Ulva lactuca*, it would be readily available to feeding birds in the drift weed wrack. The smaller algae, such as *Hormiscia*, doubtless were

TABLE 1

Species of Marine Algae eaten by the Baldpate

Species	Number of occurrences	More than 50 per cent of contents	100 per cent of contents
CHLOROPHYCEAE			
<i>Ulva lactuca</i>	22	19	6
<i>Enteromorpha intestinalis</i>	18	2	0
<i>Enteromorpha clathrata</i>	8	0	0
<i>Monostroma</i> , spp.....	3	0	0
<i>Hormiscia penicilliformis</i>	1	0	0
RHODOPHYCEAE			
<i>Chondrus crispus</i>	1	0	0
[Total number of specimens (stomach and droppings) analyzed.....22]			

taken incidentally while the ducks were feeding on the larger species; these filamentous forms commonly grow on the latter.

Marine algae may be classed as an emergency food of the Baldpate. It may be that this bird would normally feed on eelgrass (*Zostera marina*) when it is driven to salt water by cold weather. The effect of the extirpation of eelgrass (3, 4) on the food habits of the Baldpate is a matter for conjecture. It is possible that the ducks resort to algae in lieu of eelgrass, although this would be most difficult to prove because of the lack of comparative food-habits data on the Baldpate in times when *Zostera* was abundant.

GREATER SCAUP

Several thousand Greater Scaups were concentrated off the shores of Second Beach, in Middletown, during December 1934. The food of these birds appeared to consist principally of mollusks, particularly young of the sea clam (*Macra solidissima*). Only four specimens of the Greater Scaup were obtained in this area. Of these, the stomachs of two held small quantities of *Ulva lactuca*, and two droppings contained enough fragments of this plant to give a decided greenish color to the specimens.

It seems probable that in these instances *Ulva lactuca* was taken as a substitute for eelgrass, as the latter is known to have been an important food of the Scaup. Here again, however, it is impossible to give a definite evaluation of the feeding, because no data are available on the importance of *Ulva* in the food habits of the Scaup prior to the disappearance of the eelgrass.

BLACK DUCK

A brackish marsh in the town of Newport, locally known as Cotton's Creek, supports several thousand Black Ducks throughout each winter. Several pairs of 'native' Black Ducks (*Anas rubripes tristis*) nest there in spring. Feeding in winter is confined to night, while in the daytime the birds fly out to salt water.

A dam and tide-gate were placed across the outlet of this marsh at least forty years ago. The tide-gate, however, long ago ceased to function. The marsh remains slightly brackish as a consequence, and the general water level is held fairly stable at what would correspond with high-tide stage prior to the construction of the dam. The salinity of the water is too low for the growth of *Zostera*, except in the immediate vicinity of the broken tide-gate. *Ruppia maritima* occurs in fair growths in a few ponds, but is crowded out over the main body of the marsh by dense submerged mats of the marine algae, *Cladophora* and *Chaetomorpha*. These algae, together with *Enteromorpha intestinalis* and *E. clathrata*, dominate the extensive shallows over much of the marsh. These shallows represent former stands of *Spartina alterniflora* (saltmarsh cordgrass) that have been drowned out by the damming and subsequent rise in mean low-water level. Aside from the *Cladophora*, which normally are brackish-water forms, these algae attain a much greater size here than they would in water of sea strength. *Enteromorpha intestinalis*, for example, which in its typical tide-water environment produces fronds four to six inches long, here has fronds several feet long.

TABLE 2

Species of Algae eaten by the Black Duck

Species	Number of occurrences	More than 50 per cent of contents	More than 85 per cent of contents
CHLOROPHYCEAE			
<i>Chaetomorpha linum</i>	35	9	1
<i>Cladophora expansa</i>	34	4	1
<i>Enteromorpha intestinalis</i>	30	1	0
<i>Enteromorpha clathrata</i>	16	0	0

[Total number of specimens (droppings) analyzed.....38]

Cladophora and *Chaetomorpha* are thus seen to compose the bulk of the vegetable food eaten by the Black Duck. *Enteromorpha intestinalis* averaged ten per cent of the entire feeding, and *E. clathrata* usually was present only as a trace. Several of the minute unicellular algae were taken, usually attached to the larger species. These formed such an insignificant part of the food that no attempt was made to identify and study them.

Animal organisms made up a large part of the food in many specimens, but it was impossible to estimate the proportion of animal to vegetable matter in fecal analysis. Crustaceans appear to be the principal items sought, particularly *Gammarus* spp., which abound in the algal mat.

It is well known that eelgrass was formerly an important food of the Black Duck. Conditions in this particular marsh, however, lead one to believe that this feeding on marine algae is a normal occurrence. First of all, for many years the water here has probably been too fresh for eelgrass to grow. Furthermore, large numbers of Black Ducks fed in this marsh prior to the disappearance of eelgrass from the Atlantic coast. There are unfortunately no data available on the abundance of waterfowl on the marsh at that time for comparison with the present population. The possibility exists, therefore, that the present feeding on *Cladophora* and *Chaetomorpha* and other algae on this marsh may be the result of the shortage of eelgrass on former feeding grounds.

In the spring and early summer of 1935, droppings of both the adult and the young 'native' Black Ducks of this locality contained *Chaetomorpha* and *Cladophora*. This tends to support the contention that marine algae are normal foods for the waterfowl of this marsh. Evidence from other points on the Atlantic coast indicates, on the other hand, that the Black Duck will resort to marine algae as a substitute for eelgrass. The stomachs of Black Ducks taken on Long Island, New York, in December 1936, contained considerable quantities of *Ulva lactuca*.

VALUE OF MARINE ALGAE AS EMERGENCY FOOD FOR WATERFOWL

It appears from this study that ducks cannot digest efficiently marine algae of the membranaceous type, including such species as *Ulva*, *Enteromorpha*, and *Monostroma*. The fact that algal material from droppings was so little reduced by digestion as to permit of specific identification is evidence in point. The degree of digestion of algae varies with the individual bird, but in no case did the reduction of tissue in digested membranaceous algal material seem comparable with that normally found in tissues of other plants eaten by birds. Several instances were noted in which birds had passed scraps of *Ulva* fronds 5 millimeters in diameter, and almost invariably in droppings that represented feedings on this alga, plant fragments could be recognized with the unaided eye.

It must be borne in mind, however, that fecal analysis does not show the actual percentage of algal material digested. Intensive quantitative study is needed before a definite statement can be made in this regard. At the same time, superficial observation indicates that marine algae may not be so susceptible of digestion as other plant materials, and for this reason the value of algae as an emergency food is questioned.

Despite the apparent indigestibility of marine algae, the ducks under observation remained in comparatively good condition after several weeks of feeding on these plants. No evidence was found that the Baldpate took any food other than marine algae during this period, although it is recognized that there are many foods that cannot be detected in fecal analysis. Thus it would seem that marine algae of the species discussed form an adequate emergency food for the Baldpate during protracted cold weather. Furthermore, these algae are important in supplementing the animal diets of the Greater Scaup and the Black Duck.

SUMMARY

During the winter of 1934-35, certain waterfowl were found to feed on marine algae in Newport County, Rhode Island. The Baldpate, when driven to salt water by the freezing over of the fresh-water marshes, fed extensively on *Ulva lactuca* and *Enteromorpha intestinalis*; Scaups took small quantities of *Ulva lactuca*; and a local concentration of Black Ducks subsisted to a large extent on the brackish-water algae *Chaetomorpha linum* and *Cladophora expansa*.

The occurrence of marine algae in the food of these ducks may have a particular significance in view of the present dearth of eelgrass on the Atlantic coast. Possibly the Baldpate normally would feed on eelgrass when driven to salt water, and has resorted to algae as a substitute. This seems even more probable in the case of the Scaup. The feeding of the Black Duck on brackish-marsh algae seems more likely to be a normal occurrence in this particular instance. In all cases, however, lack of comparative food-habits data during times of eelgrass abundance makes it possible only to speculate on the extent to which algae are important as a substitute food.

Marine algae appear generally to be partially indigestible. The filamentous forms such as *Cladophora* and *Chaetomorpha* seem to lend themselves more readily to avian digestion than do the membranaceous forms, such as *Ulva*. Nevertheless, these algae were found to constitute an adequate emergency winter food for the Baldpate. Moreover, they dominated the vegetable portion of the feedings of the Scaups and the Black Ducks studied, and formed an important addition to the animal-food items taken by these birds.

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U. S. Biological Survey
Pilot Town, Louisiana

SOCIAL HIERARCHY IN FLOCKS OF THE CANARY

BY HURST HUGH SHOEMAKER

INTRODUCTION

THE attention of biologists was focussed by Darwin upon the question of animal fighting and competition. It was not until many years later that biologists began to realize that group integration and cooperation was an equally important force in the living world. Colonies of ants and termites, herds of mammals, and flocks of birds demonstrate types of social organization familiar to all. Allee (1931) has shown that the roots of this social life extend far lower than these in the animal kingdom, even so far as to include all of the phyla of animals. Many social groups as of ants and termites have utilized the potentialities of cooperation to such an extent that fighting within the social unit does not exist. With vertebrates, however, this high degree of harmony within the group never exists and some fighting usually occurs between members of the group and may even occur between male and female of a monogamous pair and between them and their offspring. The survival value of such grouping is shown in many ways: (1) greater defensive strength in numbers; (2) more eyes in more directions to detect predators; (3) heat conservation in severe weather; (4) ease of finding food to be shared by the group; (5) proximity of sexes insuring greater fertility; and finally, (6) group breeding may result in lessened mortality of the young.

The fact that societies of vertebrates often are organized so that the individuals exhibit a certain order of precedence is probably not familiar to many except in human institutions where it may frequently be seen, as for example in a university community, an industrial organization, or an army. While students of the social insects have pointed out that this method of organization is much inferior to that found among the termites and Hymenoptera, it is recognized to be superior to no organization at all and appears to be basic, at least for vertebrates. Human society has gone a great distance in substituting intelligence for force in inter-individual relations but only a glance at a daily newspaper should be sufficient to show that man is still upon the lower level in dealing with international relations. The present study of canaries is not meant directly to solve our human problems but it does form one small chapter in the field of general sociology of which the sociologies of men and canaries form parts.

In studying a flock of domestic fowl, Schjelderup-Ebbe (1922a) found that the individuals usually arranged themselves in a definite linear order of dominance as determined by pecking. This he called the 'peck order.'

In such an order A pecked B, C, D, E, and F. B pecked C, D, E, and F, etc., down to F who pecked no bird. This order of position was established upon the first meeting between two individuals and remained constant until a revolt occurred after which a new constant order persisted providing that the revolting bird was winner of the fight. When strange birds were introduced into a pen with resident birds, the latter usually took the dominant position. While this last phenomenon is not strictly comparable to 'territory' as used below, it is probably basically similar.

The social organization was frequently complicated by a triangle situation in which A pecked B, B pecked C, and C in turn pecked A. Since an order is based on a series of first combats and, once established, tends to remain constant, it is easily seen how such a triangle could become fixed. Schjelderup-Ebbe studied birds of more than fifty species, including the common canary, and in all of them this fixed hierarchy was supposed to have existed. It should be noted, however, that detailed description was given for the domestic fowl only.

Katz and Toll (1922) attempted to correlate the position of fowls in the social hierarchy with the ability to learn certain simple problems. While the chicken which was highest in the social hierarchy gave the best performance in most of the problems, the others failed to show any obvious correlation.

Masure and Allee (1934a) repeated Schjelderup-Ebbe's observations on fowls and extended them to include the pigeon. Their findings with the former supported remarkably well the findings of Schjelderup-Ebbe. The findings with the pigeons demonstrated a kind of social organization previously undescribed. Here it was " . . . the rule for inferiors to peck superiors and for the latter to retreat at times before the attack of an individual which is more usually subservient in its contact-pair relations with that particular bird." They found also an effect of spatial relations on dominance. For example one bird stood higher in the social order when near the food pan and the other when at the entrance to the roost. This effect of territory is of interest because, as will be seen, territory has a strong influence on the social reactions of the canary.

Later Masure and Allee (1934b) described the flock organization of the Shell Parakeet. This species proved to have a social organization of the type described for pigeons which is characterized as a 'peck-dominance' rather than a 'peck-right' as found in fowls. In breeding flocks the males were dominant over the females while in non-breeding ones the females were dominant. They found no significant correlation between the peck-dominance order and scores made in learning to run a simple maze. This species differed from the pigeon in that the peck-dominance, once established, tended to remain fairly constant.

Murchison (1935 a, b, c, d), studying fowls found a positive correlation between peck order and distance moved toward another bird in a runway. The former he called 'social reflex No. 1' and the latter 'social reflex No. 2.' He also found that these were correlated with the amount of treading which he called 'social reflex No. 3.' Like the other investigators with fowls he found roosters to be dominant over hens. Murchison, Pomerat, and Zarrow (1935) found no positive correlation between peck order and the size of the bird or the size of any of its organs.

Evans (1936) described a social hierarchy in the lizard *Anolis* particularly during the breeding season when sexual fighting was at its height. Winter mating and fighting were induced by injections of sheep pituitary or by antuitrin S. Normal males, castrate males, or castrate females fought and defended territory while normal females did not. A female with atrophied ovaries in January, when injected with testis material, fought males but an uninjected female failed to fight. Evans (1938) also made a field study of the territorial behavior of *Anolis*.

Uhrich (1938) investigating the social hierarchy of white mice found fighting to be very common among the males but rare among the females. The commonest type of social hierarchy in mice was exclusive dominance by one male with no fighting or resistance on the part of any of the subordinates. Little or no correlation was found between the fighting order and such factors as weight, age, and copulation order. Castration diminished the fighting of males. A male was more likely to win a fight in his home cage than in a strange one.

Blatz, Millichamp, and Charles (1937) made an extensive study of the social relations of the Dionne quintuplets, when they were between the ages of two and three years. The social ranking was determined by the number of pushing contacts and other criteria noted in a daily observation period of ten minutes. The number of social contacts was not correlated with the mental rank since the total contacts ranking was A, C, Y, M, and E, while the mental ranking was Y, A, C, E, and M.

A recent contribution to the study of social hierarchy in birds made by Noble, Wurm, and Schmidt (1938) was primarily a study of Black-crowned Night Herons but incidentally involved some interesting experiments with pigeons. Like Schjelderup-Ebbe (1935) and Masure and Allee (1934a), they showed that birds fight harder in certain space relationships, thus complicating the results of the social hierarchy study. It was an interesting observation that males, though usually dominant over females, assumed a subservient attitude in order to 'attract' the females into their territories.

The main problem of the present study was to discover the type of social organization existing among canaries and to discover what factors were correlated with social dominance. No clear analysis of all the factors in-

volved in determining dominance is reported in the literature for any species. Age has been found to be correlated with it in fowls. Sex was found to be a factor with some species in which the male is dominant and in others the female. No correlation has been shown between weight and dominance in birds. Observations connected with this problem extended from 1934 to July 1938, and are being continued. The specific experiment reported here was made after many preliminary observations which pointed the way for planning it and allow comparisons which greatly strengthen the conclusions. Space forbids reporting more at this time.

MATERIALS AND METHODS

The present study was based on five male canaries (*Serinus canarius*), numbered 39, 55, 58, 97, and 98, and five female canaries, numbered 14, 15, 17, 18, and 19. All of these birds, which were raised by the author, were from a somewhat inbred strain. The males were raised by the same pair of birds and were related on one side to the females. With the exception of male 98, which had a small dark cap, all birds were a pure yellow color. In order to insure quick and certain identification by the observer, the birds were given distinctive markings on the feathers with aniline dyes.

The flight cage containing the birds was forty inches long, twenty-four inches wide, and thirty-six inches high. There were four perches extending the width of the cage, two low near the center and two high near the ends of the cage. Small cages eight inches in each dimension were attached to the large cage. They opened to the flight cage through a door which was just large enough for a bird to pass through easily. A nest, seed cup, and water cup were provided for each small cage. Bathing dishes, hard-boiled egg, lettuce, gravel, cuttle-bone, and seed were placed on the floor of the flight cage. The males were observed in this cage for one day in order to get some indication of the peck order without the influence of the females. Then each was enclosed in one of the small eight-inch cages and the door to the flight cage blocked. To each one was then added at random one of the five females. For a week, except during the period of observation when they were allowed to go freely in and out of the flight cage, the same birds were kept in these same small cages. The week was sufficient time for them to become paired with the mates, which they kept throughout the entire experiment. Seed and water were kept constantly before the birds but fresh egg and lettuce were added daily just before observations were made in order to get a maximum of fighting in a short time.

All fighting behavior was recorded but for the purposes of this description only the decision fights were used. By decision fights is meant fights terminated obviously by the retreat of one of the participants. The term 'peck' as used here refers to a decision fight or to any advance toward an-

other bird which retreats in obvious response to the attack. In other words a 'peck' as used in this paper means any pair-contact reaction in which there is a definite outcome. Other notations made included feeding of mates, feeding of young, egg laying, nest construction, copulation, posturing, defense of territory, and any other unusual behavior or environmental incidents. During observation the author stood or sat not more than six feet from the birds which were apparently not disturbed by this factor. Daily observations were made when possible. It was impracticable to observe for the same length of time each day since on some days, during the moulting period particularly, very few pecks were dealt during the twenty to thirty minutes after the time of feeding which constituted the usual period of observation.

Although observations on the social organization of flocks of canaries extended over more than three and one-half years and are being continued, the experiment here reported began in June 1936 and ended in March 1937. During the winter the temperature, which usually remained between 68° and 74° Fahrenheit, was controlled by a thermostat and steam heat. Natural daylight was used and electric lights were never turned on at night. Some light from a street lamp shone in the window but the room was always dark enough at night to inhibit activity of the birds.

OBSERVATIONS

Type of Social Order.—Table 1 presents the distribution of the total pecks dealt and received during the entire experiment. Consideration of these data reveals that each bird dominated each other bird at least three times during the ten months. This type of social relationship indicates either a lack of complete dominance at any one time or a highly changeable system, or both. Later analysis will show that both factors are operating.

Birds numbered 14 to 19 are females while those numbered 39 to 98 are males. It is seen at a glance that males do more fighting than do females; two striking exceptions occur in the female combinations 14-19, and 15-18. In these cases most of the pecking was confined to a very few days during which one bird drove the other about the cage almost constantly. In the first case, 14 pecked 19 two hundred and forty-seven times in two intervals of five days in August and three days in October. In the second case, 15 pecked 18 two hundred and five times in an interval of eight days in September. In each case the despot, after the interval of driving, laid a set of eggs within two to ten days. This suggests an inherent mechanism for removing other females from the vicinity of the nesting site. It is also apparent that males usually dominate females but there are two interesting exceptions to this in the combinations of 15-55 and 19-97. In each of these cases the male dominated is the mate of the female involved. It will be pointed out

later that during the height of the breeding activity it is the rule for the female to dominate the mate.

TABLE 1
Total Pecks for Each Combination of Birds for Ten Months¹

B pecks A	Bird Number		A pecks B	B pecks A	Bird Number		A pecks B
	A	B			A	B	
66	14	15	47	51	18	19	18
65	14	17	37	85	18	39	3
80	14	18	96	44	18	55	14
98	14	19	376	45	18	58	3
96	14	39	11	61	18	97	14
79	14	55	37	99	18	98	45
78	14	58	60	...	...	...	...
78	14	97	28	66	19	39	7
110	14	98	45	57	19	55	12
...	...	...	...	79	19	58	6
32	15	17	36	49	19	97	55
101	15	18	342	81	19	98	8
61	15	19	70	...	...	...	...
75	15	39	13	227	39	55	89
27	15	55	198	169	39	58	157
111	15	58	39	344	39	97	125
86	15	97	19	712	39	98	356
86	15	98	16	...	...	...	...
...	...	...	...	44	55	58	501
10	17	18	33	396	55	97	64
59	17	19	48	394	55	98	185
68	17	39	57	...	...	...	...
41	17	55	25	273	58	97	344
44	17	58	8	620	58	98	172
68	17	97	18	...	...	...	...
154	17	98	4	175	97	98	1,008

¹ To read table use for example the first line: 14 pecks 15 forty-seven times while 15 pecks 14 sixty-six times.

Effect of Sex on Position in the Social Order.—Table 2 reanalyzes information found in Table 1 on the basis of sex. It is seen that the least dominant male pecks more than the most dominant female. The total male pecks are 8,222 as against 2,471 for the females. It is further seen that these birds peck others of the same sex more than they do others of the opposite sex. Females peck females 1,726 times while females peck males 745 times and males peck males 6,355 times while males peck females only 1,867 times.

TABLE 2

Distribution of Pecks According to Sex

Homosexual female pecks				Heterosexual female pecks			
14 pecks all females	556	and pecks all males	181	total	737		
15 " " "	514	" " " "	285	"	799		
19 " " "	269	" " " "	88	"	357		
18 " " "	209	" " " "	79	"	288		
17 " " "	178	" " " "	112	"	290		
<hr/>				<hr/>			
1,726				745 2,471			
Homosexual male pecks				Heterosexual male pecks			
97 pecks all males	2,021	and pecks all females	342	total	2,363		
98 " " "	1,901	" " " "	530	"	2,431		
55 " " "	977	" " " "	248	"	1,225		
58 " " "	729	" " " "	357	"	1,086		
39 " " "	727	" " " "	390	"	1,117		
<hr/>				<hr/>			
6,355				1,867 8,222			
				<hr/>			
				Grand total 10,693			

In Table 3 the birds are ranked in order of dominance. Again, this arrangement shows clearly that males dominate females as a rule. The exceptions due to the female dominating her own mate are shown by the blanks in the lines following all of the males except 39.

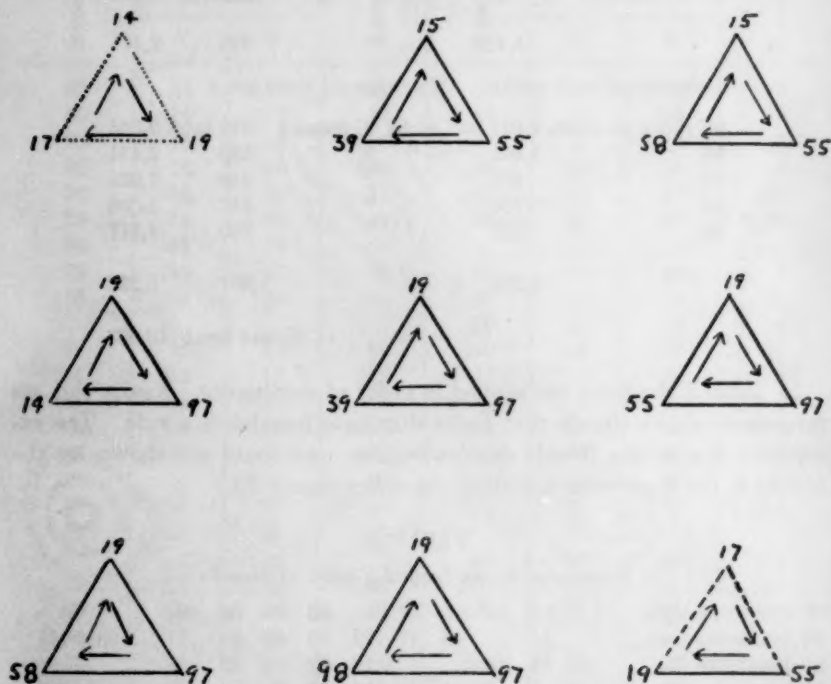
TABLE 3

Dominance during Largest Number of Months

97 dominates eight	14	18	15	17	..	39	55	58	98	..	..
98 dominates seven	14	..	15	17	19	39	55	58	..	..	(ties 18)
55 dominates five	14	18	..	..	19	39	..	58	..	..	..
58 dominates five	..	18	15	17	19	39	..	..	..	..	..
39 dominates five	14	18	15	17	19	..	..	..	..	..	(ties 14)
19 dominates four	..	18	15	17	..	..	..	..	..	97	..
17 dominates four	14	18	15	..	..	..	55	..	..	..	..
15 dominates three	14	18	..	..	..	..	55	..	..	..	..
18 dominates one	14	..	..	..	..	..	..	..	..	..	(ties 98)
14 dominates one	..	..	..	..	19	..	..	..	..	..	(ties 58)

The domination of the males by their mates creates many of the triangle situations among canaries such as have been already described for fowl. These triangles may exist among birds of the same sex as seen by the triangle of females indicated by the dotted lines in Text-figure 1 which is made from data presented in Table 3. One triangle is produced by a female dominating a male which is not its mate, as indicated by broken lines, but

the other seven are produced by females dominating their mates. Attention is called to the fact that 15 and 55 are mates as are 19 and 97. Triangles are always produced when a bird dominates another which in general relations stands higher in the peck order. In the first triangle, for example, 14 dominates 19, 19 dominates 17, and 17, in turn, dominates 14, while from the general reactions the expected order would be: 19 dominates 17 and 14, 17 dominates 14, and 14 dominates none.



TEXT-FIG. 1.—Triangles formed by ranking in order of dominance.

Effect of the Breeding Activity.—When no breeding is going on, so little pecking takes place in the flock that it is not profitable to make observations except for the few minutes after fresh food is given. This is one of the reasons that the birds were not watched for a uniform period of time. It is also pertinent to note that the three highest-ranking males in the flock represent the only pairs to raise any young to maturity. Male 39 and its mate are seen in Table 4 to have raised one young bird to about one-half the age necessary to leave the nest before it died. The pair 58 and 14 had only two sets of eggs, hatched young once, and did not feed these. It is impossible to determine by the information at hand whether these nesting

failures were due to the males, the females, or both. The following observations, however, seem to be significant. An indication that circumstances coincident with breeding affect the order of dominance is brought out by the contacts of 58 and 98. Due to the close proximity of 55's territory, cage

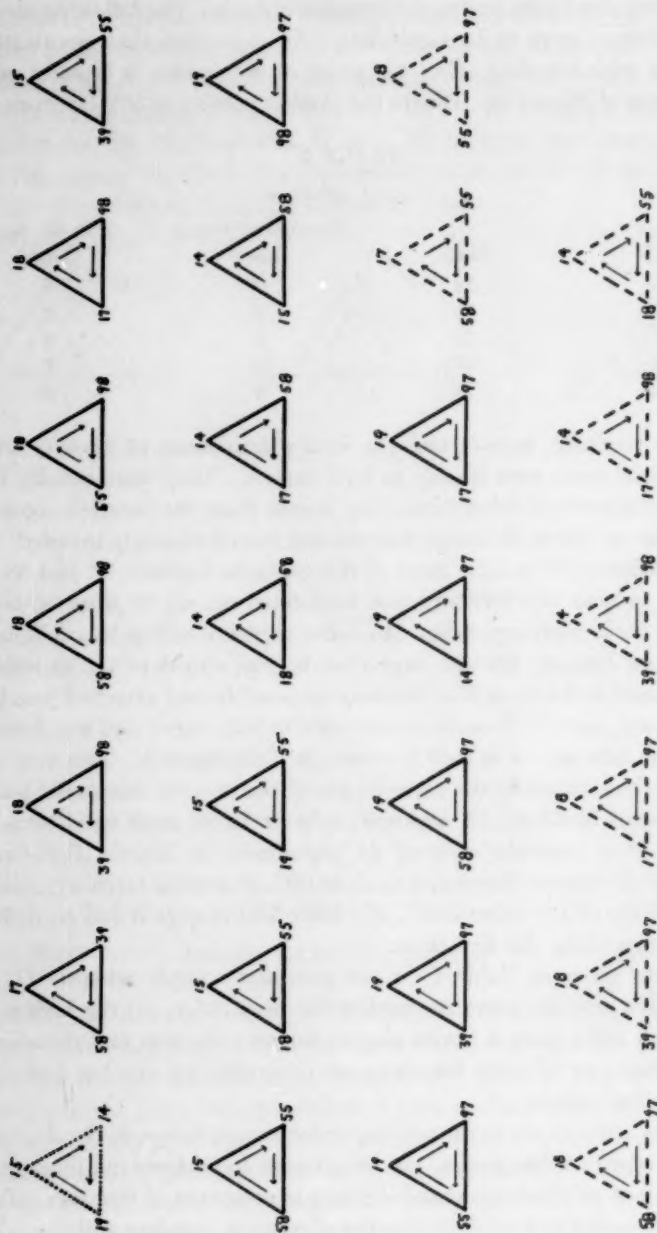
TABLE 4
Nesting Activities

Male	Mate	Number of young raised	Sets of eggs laid
98	18	9	5
55	15	6	6
97	19	3	8
39	17	$\frac{1}{2}$	7
58	14	0	2

4, to 58's territory, cage 5, and the strong dominance of 55 over 58, the latter and its mate were unable to hold cage 5. They were usually found invading the nests of other birds. As is seen from the detailed account of territory given below, 98's cage was the one most frequently invaded. Due to this tendency to invade, most of the contacts between 98 and 58 were fought in or near 98's territory and were thus won by 98 since birds fight harder in their own territories. In order to see whether 58 could hold a territory, in January another cage (No. 6) was added to the experiment. It was placed as far from 55's territory as possible and attached just below 98's territory, cage 1. Soon 58 became able to hold cage 6 and was dominant to 98 from then on. The shift is shown in Text-figure 3. This may mean that 58 is fundamentally the superior one of the two but due to the peculiar circumstances involved, 58 appeared inferior to 98 until conditions were revised. At or near the close of the experiment in March, Text-figure 3 shows that 58 became dominant to all but 97, in neutral territory. Shortly after the close of the experiment, 58's mate laid in cage 6 and 58 defended the nest from all for the first time.

The data given in Table 4 do not necessarily imply whether (1) high reproductive activity raises the bird in the peck order, (2) the higher birds in the peck order have a better chance for reproduction and therefore reproduce more, or (3) both functions are controlled by another factor such as the pituitary gland.

Breeding activity alters the pecking order since it increases the dominance of the females over the mates. In an attempt to analyze and illustrate the importance of this factor a detailed study is presented of the data collected during November as one of the months of greatest breeding activity. Table 5 shows the ranking of dominance for that month determined by the number of birds of the same sex dominated over the largest number of days of



TEXT-FIG. 2.—Triangles formed in rank of dominance for November. homosexual triangles; — heterosexual triangles caused by the female dominating mate; - - - heterosexual triangles caused by female dominating non-mate male.

TABLE 5

Rank of Dominance based on Despotism for Month of November

		Homo.	Het.										
Males	97	4	3	15	..	14	..	17	58	39	55	98	..
	98	3	3	15	19	..	..	17	58	39	55	..	..
	55	2	2	..	19	..	18	..	58	39	..	..	..
	39	1	4	15	19	14	18	..	58	..	..	..	..
	58	0	4	15	19	..	18	17	..	..	..	..	..
Females	17	4	2	15	19	14	18	..	..	39	55	..	..
	18	3	2	15	19	14	..	..	..	..	..	98	97
	14	1	3	..	19	..	..	..	58	..	55	98	..
	19	1	1	15	..	..	..	..	..	..	..	..	97
	15	1	1	..	..	15	..	..	..	..	55	..	..

the month. As might be expected from the above observations all five females dominated their mates during November and this dominance extended in some cases to males which were not their mates. This increased domination of the mate by the females naturally led to a great increase of triangle situations for November. These are shown in Text-figure 2. During this month there were eighteen heterosexual triangles caused by females dominating their mates, eight heterosexual triangles caused by females dominating males which were not their mates, and one homosexual triangle. It is significant that there was no increase in the number of homosexual triangles.

With increased breeding activity dominance increased in many instances. Attention is called to Text-figure 3 for reference to all cases mentioned in this paragraph. Before the experiment began, and before the five regular females of the experiment were introduced, another female had been present with the five males. 39 paired with this female and was the dominant bird in the flock keeping all the other males at a distance. The dominance lasted for a few days after this female was removed and the females of the experiment were introduced. During this time 39 and this female called to each other almost continuously. 39 then went down in the social ranking and 97 became dominant and held its dominance over all through the rest of the experiment except that from August to October, 58 dominated 97. As is seen in Table 4, 97 is the male whose mate laid the greatest number of sets of eggs.

Examination of Text-figure 4 reveals the changes from day to day, some of which appear to be associated with breeding activity. On November 4, 39's young hatched and on November 5, 39 dominated three males and equaled the fourth. On November 16, 39 and its mate were building a new nest when 39 became dominant over 55 and 97 and raised its ratio of pecks

given to 58 and 98. On November 2, when 55's mate laid, 55 became dominant to all other males and on November 15 and 16, when the young hatched, 55 became dominant to 39 and 98. 97 became dominant to all males and overcame 58, which it had never dominated as 97 and its mate started a new nest on November 7 and 8. When its mate laid on November 20, 97 became very despotic and this caused it to show a high ratio of pecks over the other males. On November 27, as 98's mate was about to lay, 98 revolted against 97 and raised its ratio of dominance over the other males.

NATURE OF DOMINANCE IN CANARIES

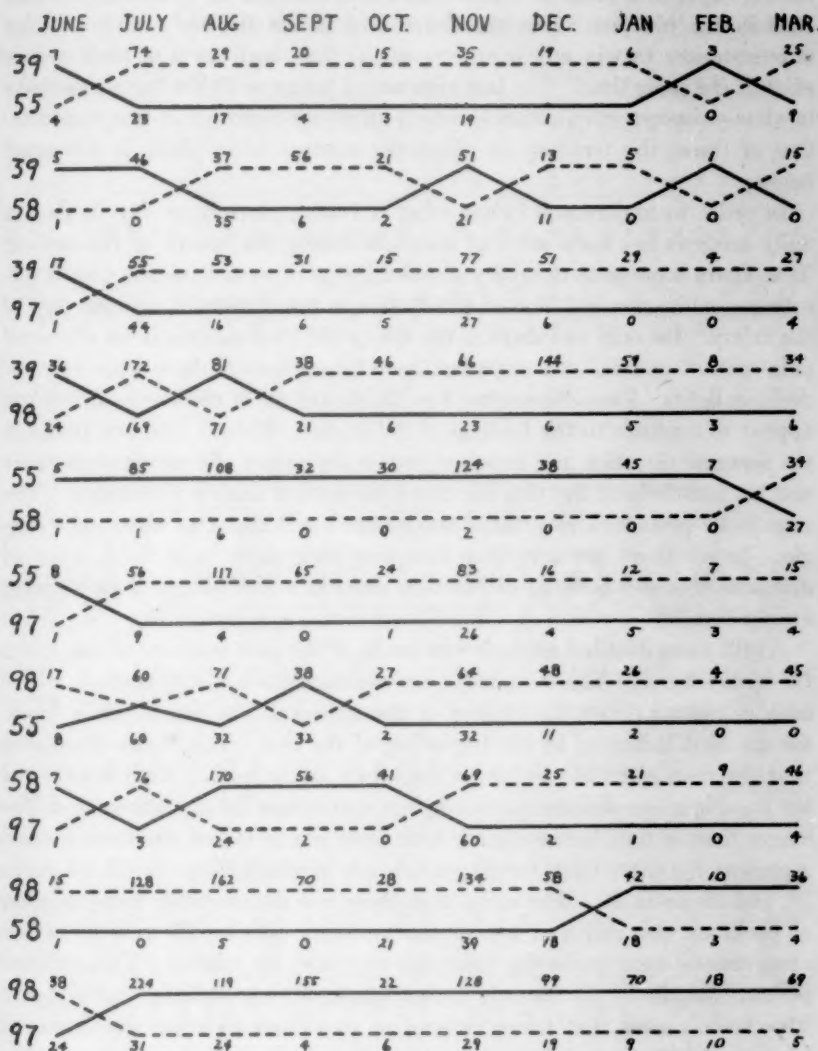
Due to the fact that the nature of the dominance existing in flocks of canaries is a disputed question, it deserves careful description. The question at hand is whether the social order is of the rigid 'peck-right' type or the 'peck-dominance' type. The former was described for fowl by Schjelderup-Ebbe (1922) and confirmed by Masure and Allee as a type in which one individual invariably, or almost invariably, had precedence over the other. The latter type, described by Masure and Allee (1934a) for pigeons, has been referred to as a 'win-or-lose' relationship where first one bird retreats and then the other, the one retreating the fewest times being said to show peck-dominance. Schjelderup-Ebbe recognizes only the first type and lists the canary as one of the birds manifesting it. A detailed description of the contacts of the same five male canaries is given below. Since the females showed essentially the same thing and since their contacts are much less frequent, they are not described in this section. The orders of dominance, from month to month, are summarized in Table 6 where the number of

TABLE 6
Ranking of Males on Basis of Number of Males Dominated

June		July		Aug.		Sept.		Oct.		Nov.		Dec.		Jan.		Feb.		Mar.	
Bird	Dom.	Bird	Dom.	Bird	Dom.	Bird	Dom.	Bird	Dom.	Bird	Dom.	Bird	Dom.	Bird	Dom.	Bird	Dom.	Bird	Dom.
39	4	97	4	97	3	97	3	97	3	97	4	97	4	97	4	97	4	97	4
98	3	98	2½	98	2	55	3	98	3	98	3	98	3	98	2	98	2	57	3
55	2	55	2½	55	2	98	2	55	2	55	2	55	2	55	2	39	2	98	2
58	1	39	1	58	2	58	2	58	2	39	1	58	2	58	2	55	1	55	1
97	0	58	0	39	1	39	0	39	0	58	0	39	0	39	0	58	1	39	0

males dominated is listed after the bird dominating. In the case of a tie each of the two birds involved is given one-half. The order of dominance, as a whole, is far from stable but certain individuals tend to remain fixed after the initial period of adjustment. Text-figure 3 gives in addition the birds which are dominated and the scores for each combination for each

month. It reveals for periods of one month, that nineteen of the one hundred pair-combinations (five birds for ten months) have pecks in only one



TEXT-FIG. 3.—Numbers represent pecks for the male at the beginning of the line.

direction. There are all variations from this complete dominance to combinations in which the same number of retreats occurs for each member; sixty to sixty in one case. From Text-figure 3 we are forced to conclude that

one of three conditions exists: (1) that the nineteen cases represent the 'peck-right' condition and that the other eighty-one represent periods of revolt; (2) that a state of win-or-lose exists between all combinations and that in the nineteen cases the lower bird is not favored sufficiently by circumstances to win any contacts; or (3) that both sorts of peck orders exist at the same time. The last view seems better to fit the facts especially in view of known circumstances which affect the outcome of pair contacts. One of these, the territory in which the contact takes place, is discussed below.

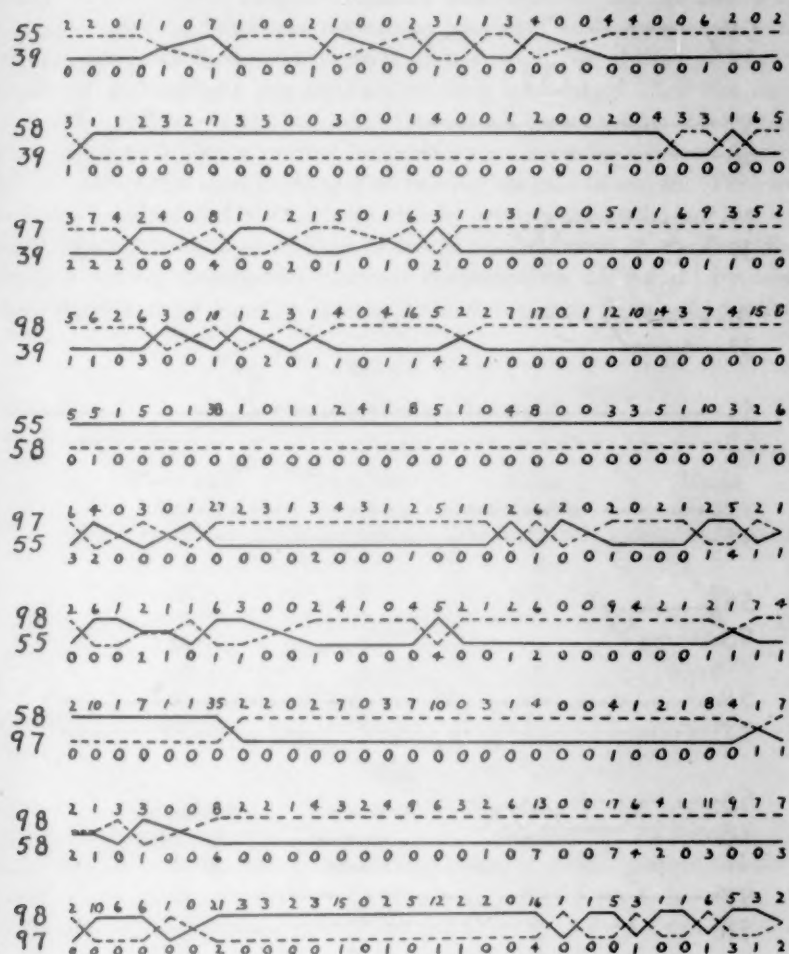
In order to understand better what is taking place from day to day, a daily analysis has been made of contacts during the month of November. Text-figure 4 presents the daily distribution of observed pecks. One interesting combination is 55-58 in which 58 was not dominant a single day of the thirty. On only two days of the thirty did 58 dominate in an observed pair contact and this was seen but once for each day; there were no non-decision fights. From November 3 to 29, the results of this one combination appear to conform to the findings of Schjelderup-Ebbe. The two pecks in the reversed direction are, however, not of the nature of a revolt since there was no non-decision fighting for this combination during November. The case 58-97 presents a reversal of dominance but without an observed struggle. In all there are forty-one complete exceptions to a fixed order of dominance to say nothing of fourteen days in which observed pecks were evenly divided.

A still more detailed analysis was made of the pair contacts of the males for November 7. These contacts are summarized in Text-figure 5, where each dot along either the broken or the unbroken line represents a 'peck' for the bird indicated at the beginning of the line. This figure illustrates that reversals often last no longer than for a single 'peck.' Only four of the ten combinations demonstrate complete dominance for the whole day. The longer lines of dots indicate birds with more contacts and the three longest represent the three birds forming a triangle in which 97 pecks 55, 55 pecks 58, and 58 pecks 97. The facts, that there was an unusually large number of pecks on this day and a complete reversal, placing 97 over 58 before observations were made the following day, may be related. This reversal permanently broke up the only male triangle of long standing and supports Murchison's view that triangles tend to give place to linear dominance if given sufficient time. It is worthy of note that these males had been together for one hundred and thirty-three days before November 7, and their social rank was supposedly on a steady basis. This shift in dominance is normal and in most cases, as can be seen in Text-figure 4, occurs much more frequently.

Effect of Territory.—Eighteen (33 per cent) of the fifty-five complete

exceptions to the fixed order of dominance and cases of even distribution referred to in Text-figure 4 can be traced definitely to the effect of territory.

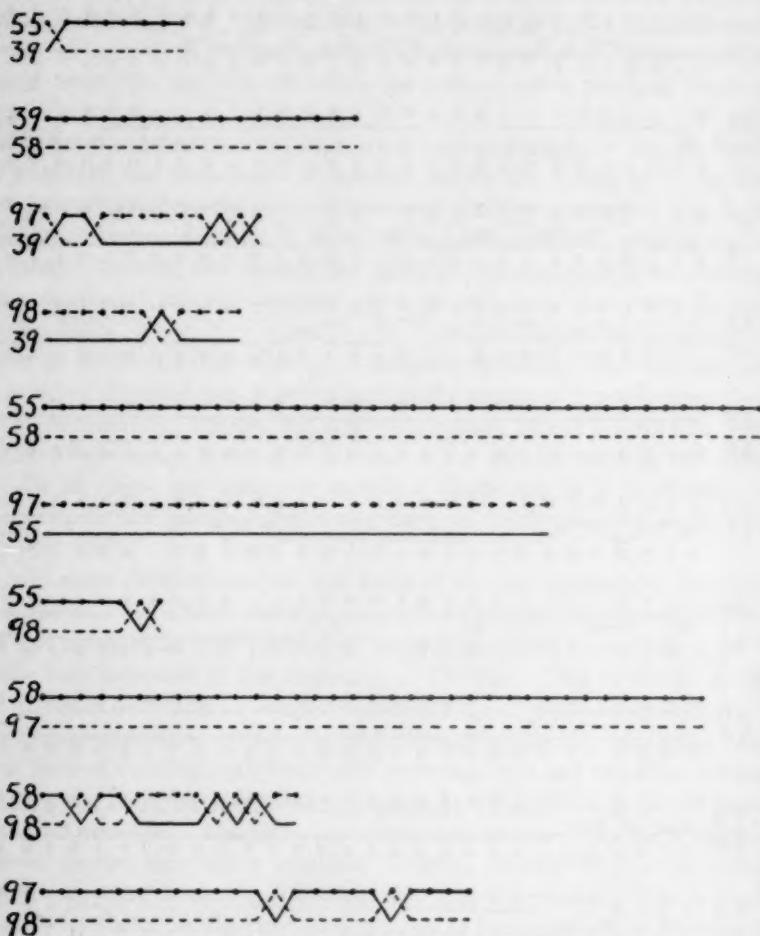
NOV. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30



TEXT-FIG. 4.—Male contacts for November.

For example, all but one of the deciding contacts which caused 39 to win over 55 for five days, were fought in or near the entrance to the nesting cage of 39. In other words, the circumstance which caused 39 to fight harder in these cases was the proximity of its nest. The areas of the de-

fended territories radiated from the small cages, including the nests, to different distances depending on various factors, such as the dominance ranking of the defender and that of the invading bird. Even for the same combination of birds the area defended differed from day to day and de-



TEXT-FIG. 5.—Male contacts for November 7.

ended, among other known factors, on the time in the egg-laying cycle. At times 39 defended not only its nesting cage from 98 but also the two higher perches. Late in the evening, it was noted on several occasions, that 39 could still hold the nesting cage but not the two perches. This may have been due to a tendency of the weaker bird to become fatigued. On

rare occasions all tendency to defend territory, even of the nesting cage, was lost.

For the convenience of analysis only the pecks won or lost in the nesting cages are included in what is called 'territory' in Table 7. If all contacts in the territory limits between 'resident' and 'intruder' for the month of November are added there are 168 won by 'residents' and twenty-seven won by 'intruders.' Of these twenty-seven, all but two involved the pair 14 and 58 whose territory was not localized to their own cage. They not only defended cage 5 poorly but 'attempted' to defend cages used by other birds. The important influence exerted by territory is shown by the total figures but it becomes still more striking if we rule out the pair 14 and 58. Then we have one hundred and one contacts won by 'owners' and only two lost, or about two per cent of exceptions to complete dominance in territory distributed among twenty-two different combinations of birds. Females drove away females more times than males drove away females and males

TABLE 7
Territory Defense for November

Female				
Bird	Times bird defended territory	Times bird lost to invader	Times defended against males	Times defended against females
14	5	1	5	0
15	1	0	1	0
17	2	0	2	0
18	14	0	0	14
19	8	1	8	0
	—	—	—	—
Total	30	2	16	14

Male				
Bird	Times bird defended territory	Times bird lost to invader	Times defended against males	Times defended against females
39	39	2	36	3
55	9	0	9	0
58	7	17	7	0
97	32	6	31	1
98	51	0	47	4
	—	—	—	—
Total	138	25	130	8

Total contacts in territory in November—195

Contacts won in territory in November—168

Contacts lost in territory in November — 27

drove away males more times than females drove away males. Though females drove away males slightly more often than they did females, the fact that most of the invasions were made by males made a decidedly greater percentage of the defenses homosexual.

At least one case of territory defense deserves special note.

November 14—Female 18 hatched two young in nest 1.

November 20—When young were six days old and 18 was off nest 1 more frequently 14 was seen to enter nest 1 and proceed with nest building on top of 18's young. Three times 18 was seen to drive 14 out of cage 1, which contained nest 1, and twice to drive her off perch 1, which was near.

November 22—Female 18 drove 14 from cage 1 once.

November 23—Female 18 drove 14 from cage 1 four times.

November 24—18 drove 14 from cage 1 twice.

November 25—18 drove 14 from cage 1 twice. 14 pecked 18 once on perch 1 and once on perch 3; fought back at 18 for the first time in a month.

November 27—18 drove 14 from cage 1 once and pecked her once on perch 4. 14 pecked 18 six times on perch 1, three times on the floor, and once on perch 3. 14 was now able to hold perch 1.

November 28—18 did not peck 14. 14 pecked 18 four times on perch 1 and once on perch 4.

November 29—18 pecked 14 twice on perch 1 and once on perch 4. 14 pecked 18 three times on perch 1 and once on the east wall. 18 was again partially able to hold perch 1.

November 30—18 pecked 14 six times on perch 1 and once on the floor. 14 pecked 18 once on perch 1 and once on perch 4. 14 was now beginning to build in its own nest in cage 5. 18's dominance on perch 1 was now almost completely restored.

December 1—18 pecked 14 on perch 1 once.

December 2—18 drove 14 from cage 1 once.

December 5—18 drove 14 from cage 1 twice.

December 7—18 laid its first egg in nest 1. No more contacts were observed between 18 and 14 until Christmas day, when 18's young were four days old; then 14 started building on top of 18's young again and the same kind of conflict as the above started all over.

It is observed in this case that female 18 did all of the defense of cage 1 from the intrusion of female 14. This may have been due to the polygamous behavior of 98 in regard to 14. Of these discussed here, 98 (mate of 18) is the only male which fed, mated, and carried cotton at all regularly to any other female than its own mate; 14 was the only other female which received this attention. Territory is usually defended by the male but due to 98's peculiar behavior, 18 was left to defend cage 1 against 14.

RELATION OF RANK TO NUMBER OF PECKS DEALT

Schjelderup-Ebbe reports that chickens at the top of the peck order do less pecking than lower-ranking ones. Masure and Allee (1934 a and b) find the opposite to hold in their study of the same species and likewise with

pigeons and parakeets. Among canaries the ranking birds were also observed to have more contacts as shown by Table 8 where 97 and 98, the two highest-ranking birds based on either method of ranking, dealt far more pecks than lower-ranking birds. This difference between the findings of Schjelderup-Ebbe and those of our laboratory may be due to the fact that in a larger pen his lower-ranking chickens were better able to avoid contacts with the higher-ranking ones.

TABLE 8

Comparison of Rankings According to Different Criteria

Ranking according to number of birds dominated during largest number of months	Ranking by number of birds dominated as shown by one dealing larger number of pecks to other over total time	Ranking according to pecks dealt (not number of birds dominated)	
		Total	Homosexual
97	98	98 (2431)	97 (2021)
98	97	97 (2363)	98 (1901)
55	58	55 (1225)	55 (977)
58	55	39 (1117)	58 (729)
39	39	58 (1076)	39 (727)
19	15	14 (737)	14 (556)
17	19	15 (699)	15 (514)
15	17	19 (357)	19 (269)
18	14	17 (290)	18 (209)
14	18	18 (288)	17 (178)

Effect of Age on Dominance.—In December and January several young were produced and they were left with the adult birds until the cage became too crowded. While with the adults, while they are being fed by their parents and for a short period afterward, pecking observations were made on the young also. Comparison of the number of pecks dealt by young to adults and by adults to young gives information as to the effect of age on dominance in the peck order. Observations were made on nine young males and five young females. Age made very little, if any, difference in dominance either in males or in females. Although the observed differences are not large, males tended to dominate females no matter what the age. Male dominance over females must therefore appear very early since the oldest young were removed at fifty-one days of age. The first contacts were observed when the young were twenty-six days of age. Even at that age young pecked adults as frequently as adults pecked young.

Effect of Body Weight on Dominance.—Apparently no correlation exists between body weight and dominance as seen in Table 9. The lowest and highest ranking males are about equal in weight and are the lightest males in the flock. Similarly, the ranking female is the lightest and the heaviest

female is next to the lowest in dominance. Though males regularly dominate females they average slightly less in weight. This weight difference in favor of the females conforms to similar differences in averages of weights of about seventy-five canaries.

TABLE 9

Dominance and Body Weight

Sex	Ranking by dominance	Ranking by weight		Average weights
		Bird	Weight in grams	
Males	97	55	20.4	17.7
	98	98	18.2	
	55	58	17.5	
	58	97	16.4	
	39	39	16.0	
Females	19	18	19.4	18.4
	17	15	19.2	
	15	14	19.1	
	18	17	18.3	
	14	19	16.1	

Relation of Dominance to Behavior in a Simple Problem Box.—From June 27 to October 6, except for a few days in late August and early September, the five adult males and five adult females described were tested daily in a simple two-alley problem box. These birds had previously been trained to go down the alley with the red or green colored light by being released from the box after a correct performance. The construction of the box has been described previously by Allee and Masure (1936) and except for one change that description still holds. This change involves the insertion of a door at the entrance to each alley from the main runway. As soon as an error was made the door to the alley involved was closed for a few seconds and then opened to release the bird into the runway. It was then closed to prevent repetition of the error and thus only one error could be made at any one run. Table 10 shows no apparent correlation between dominance and behavior in the problem box either with smallest number of errors or shortest time spent in each run. These figures do not represent errors required to learn the problem since all of the birds were familiar with it at the beginning of the experiment. The superior performance of the males over the females is in accord with the results of Allee and Masure (1936) with Shell Parakeets.

Other Factors affecting Dominance.—The reversal making 98 dominant over 39 was gradual and lasted over a period of about three months. At an intermediate time during this reversal 39 was found to be able to win in approximately half of the contacts. During this time it was found that late in the day 98 won all of the contacts except those in the nesting territory of

39. This loss of dominance by 39 in the evening may have been due to a lower resistance to fatigue. Also when two birds were closely matched and one became incapacitated in flying by having the feathers wet from bathing the other often took advantage of it.

TABLE 10
Dominance and Problem Box Behavior

Sex	Ranking by dominance	Ranking by errors occurring in seventy-nine trials			Ranking by time in box	
		Bird	Errors	Per cent errors	Bird	Average time
Male	97	39	3	3.8	39	4.3
	98	98	3	3.8	98	4.4
	55	58	4	5.1	58	4.4
	58	97	5	6.5	55	4.5
	39	55	6	7.6	97	5.1
Female	19	17	6	7.6	19	5.6
	17	19	7	8.9	15	9.8
	15	15	7	8.9	17	11.9
	18	18	7	8.9	14	12.0
	14	14	10	12.6	18	15.2

An observation, which has no ready explanation, is the severe flogging occasionally given the mate by a male just previous to nesting. This may be immediately preceded or followed by the usual gentle pecking by which the females dominate their mates. The two types of contacts have no comparison in severity since in the former the male often held the female in its claws and dealt severe pecks at the head and eyes. Masure and Allee (1934b) describe regular dominance of the male over the female in parakeets during nesting. By pecking, the male parakeet drives the female to the nest. This does not explain the floggings in canaries since the male usually coaxed the mate to the nest by posturing to the nest, sitting on the edge, and uttering the sounds which accompany feeding. In parakeets the females dominate the males except during the breeding season.

DISCUSSION

Various explanations of the results may be offered which seem to differ from those described in the more fixed type of social hierarchy of the fowl. Cases in which a canary with a morsel of lettuce, too large to be eaten at one bite, ran away from inferiors were observed. Such cases were not counted.

Cases of pecks dealt by a maturing bird to a superior preliminary to the actual revolt have been observed in fowls. This possibility was ruled out

because young birds were not included in the experiment except in the one section on effect of age. They are not included in the figures which show the incomplete dominance characteristic of the species.

Subordinate fowls, at times, ate food from the bills of resting superiors and this might have been confused with a peck. If such occurred among the canaries it was not counted as a peck.

When a strange bird is introduced into a flock it may win the first few fights but, being outnumbered by resident birds, is weakened in fighting so that all come to dominate it in a short time. Such a condition could not have existed in this experiment since strange birds were never introduced after the experiment began.

Pecks dealt in play and sham battles have been suggested as an explanation but it was impossible for the author to distinguish a sham battle, if such existed in canaries, from a real battle. As for pecks dealt in play, the nearest approach was the gentle pecking of a male by its mate, in response to which the male postured away a short distance instead of fleeing in the usual manner.

So it appears that canaries follow the same type of social organization as described for pigeons and Shell Parakeets. The rule that one bird invariably dominates or is dominated by another must indeed be taken with a large grain of salt if applied to all birds.

It is possible, other things being constant, that any one of several factors such as body weight, intelligence, metabolic rate, age, fatigue, or amount of sex hormone present could be shown to be correlated with social dominance. But due to the fact that several factors are operating at once, and the improbability of keeping the other factors constant taken together with the small numbers which can be followed at any one time, it is difficult to find a very significant correlation of social dominance with any one of these factors. Except for sex and breeding activity, which are discussed at length above, the correlation between social dominance and any one factor in the physiology of the canary is probably slight. This view is supported by the frequent occurrence of triangle situations which must be due to coincidences as described in the introduction and could not possibly be due to the physiological vigor of all three birds at any one moment. These coincidents are perpetuated in the conditioned behavior of the birds. No single physiological factor could logically bring about a triangular situation such as 98 pecks 58, 58 pecks 97, and 97 pecks 98. For example, 98 is heavier than 58 and 58 is heavier than 97, therefore 97 could not be heavier than 98. However, the above triangle existed during August, September, and October, as can be seen in Text-figure 3, and the differences in the numbers of pecks are too large to be due to chance in sampling. This example is explained in such detail to emphasize the importance of coinci-

dences affecting the nervous system and perpetuated beyond the time when the fighting ability establishing it may have changed.

The correlation of dominance with sex and breeding activity suggests the possibility that social dominance is in some manner under the influence of a sex hormone. In 1936, following this suggestion, castrate and normal female canaries which were not in breeding condition were injected with estrone. No changes were observed in their social dominance or breeding activity. Working with the lizard, *Anolis*, Evans (1936) finds that the urge to fight is inhibited by hormones secreted by the ovary since normal females do not express dominance but castrated females do. He also has some evidence that injection of testis material into normal females stimulates fighting. Domm (1937) finds that injection of the gonadotropic substance, hebin, increases the fighting and produces precocious sexual behavior in baby chick males but not in females. Domm (1927) also finds that capons do not fight as vigorously as cocks. He states that the female fowl, while actively laying, has been shown to produce male hormone as well as female hormone. It is this male hormone which induces the characteristic comb growth in laying hens, since injection of female hormone is shown to have no such effect. Female canaries are frequently observed to sing as well as to fight much more while coming into the laying condition. One female canary while in this condition was frequently observed to tread other females and in their absence to tread males. Soon afterward it reacted as a normal female to the treading of a male, laid eggs, hatched, and reared young. This happened to this female each time before laying. It logically follows that singing, fighting, and masculine mating behavior may also be due to male hormone produced by the ovary of the female canary and by the testis of the male. Experiments to test this theory by injecting male hormones into female and male canaries are being planned.

The field study of 'territory' has attracted much attention of students of bird life for many years. It has been shown that birds fight much more violently in the vicinity of their nests. This area defended from intruders has come to be known as 'territory' in a rather technical sense. Howard (1920) has come to the conclusion that all fighting in birds is 'territory' defense. This extreme view was apparently a reaction from another held by Darwin, that fighting is primarily in reference to the mate. Craig (1921) takes a much broader view that "the animal fights in order to gain or to retain possession of that which is of value to him, such as food, mate, or nest." Though he recognizes the importance of territory, Tinbergen (1936) cites the case of the Snow Bunting in which a male, wandering into the territory of another, will not attack the resident male unless the former is accompanied by its mate. It is this fighting, whether it be in the vicinity of the nesting territory, food, bathing dish, or mate, which forms the basis

of social dominance. Cases were observed in the canaries where fights have obviously originated over each of these. The contacts originating in response to territory defense, however, far outnumber all the others. The expression of territory defense is of great importance in the study of the social hierarchy in the canary since a bird which is dominant to another in neutral territory normally becomes subordinate in the nesting territory of the other bird. This factor of territory alone would be sufficient to explain the occurrence of a 'peck-dominance' type of social hierarchy in the canary instead of the 'peck-right' type as described for fowl.

SUMMARY

1. A social hierarchy of the 'peck-dominance' type exists among canaries, rather than the 'peck-right' type as described for fowl.
2. Age, body weight, and problem-box behavior show no correlation with the position in the social hierarchy.
3. Birds ranking high in dominance deal more pecks than lower-ranking birds.
4. Males regularly dominate females except their own mates during time of breeding, when dominance is reversed for mated pairs.
5. Position in the social hierarchy fluctuates with breeding activity. Male hormone is suggested as controlling the mechanism.
6. Birds subordinate in neutral territory become dominant in their nesting territory. This factor alone would account for the 'peck-dominance' type of social organization.

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University of Chicago
Chicago, Illinois

PTERYLOSIS OF THE BLACK VULTURE

BY HARVEY I. FISHER

THIS study is a supplement to the work of Compton (Univ. California Publ. Zool., 42: 173-212, 1938) and of Miller and Fisher (Condor, 40: 248-256, 1938) on the pterylography of cathartid vultures. Since neither of these papers considered the Black Vulture, *Coragyps atratus*, a brief comparison of the pterylosis of *Cathartes*, *Gymnogyps*, and *Coragyps* would seem to be worth while. I am grateful to Dr. William L. Engels of the University of North Carolina for sending me the alcoholic specimen of *Coragyps* (no. 76131, Mus. Vert. Zool.). The nomenclature and order of description of the above papers will be used to facilitate comparative study.

Capital tract.—In the Black Vulture there are feathers over most of the head. This is in direct contrast to the reduced feathering of *Gymnogyps*. *Cathartes* has short hair-like feathers on the head but no plumaceous feathers. Despite the reduced covering in *Gymnogyps*, the feathers of the frontal, loreal, anterior superciliary, and parts of the auricular and malar regions are plumaceous.

In *Coragyps* the plumaceous feathers of the lower occipital region, which is continuous with the dorsal cervical region, range up to 2.5 cm. in length. Semi-plumaceous feathering continues forward over the coronal region with the feathers 5-8 mm. in length and about 1 mm. apart. From posterior to anterior, the bristle-like feathers of the frontal region decrease in length to 3 mm. and become much finer. The spacing is approximately the same as in the coronal region. The frontal region ends 2 or 3 mm. back of the posterior ends of the nasal openings.

The lower part of the loreal region is devoid of feathers, but the upper part has bristles continuous with those of the frontal region. Close-set bristles, about 5-7 mm. long, cover the auricular region. This region is confluent with the coronal region dorsally and the malar region ventrally where the spacing is greater. The posterior part of the auricular region is made up of two or three rows of short bristles set posteroventrally about the external auditory meatus. In the posterior auricular region the feathers are short and about 2 mm. apart.

In the anterior inter-ramal area is an apterium that extends posteriorly from the symphysis for 2 cm. Only scattered feathers are found in the submalar area.

The bristles of the frontal region become shorter and slightly farther apart as they extend out over the superciliary region. The upper and lower ocular apteria meet posterior and anterior to the eye. In the latter instance they continue together over the loreal region almost to the corner of the mouth.

A single row of eyelashes runs along the posterior one-half of the upper eyelid. Two rows may be seen along the margin of the lower lid. *Cathartes* has this arrangement, but *Gymnogyps* has no eyelashes.

Gymnogyps has a greater area on the head devoid of feathers than either *Cathartes* or *Coragyps*. Reduction in capital covering in *Gymnogyps* has taken the form of almost complete removal of feathers in certain areas (coronal, auricular, inter-ramal and ocular), with alteration in size of other feathers. In *Cathartes* reduction has been general in all the feathers, but few have been completely eliminated. *Coragyps* shows some reduction in the plumaceous condition of head feathers, but the spacing is approximately the same as in *Cathartes*. It is interesting that extreme reduction should take place in the coronal region of *Gymnogyps* and that the loreal region should have plumaceous feathers. The opposite condition is found in *Coragyps* in that the coronal region is heavily covered with plumaceous feathers whereas the loreal region has only bristles. The bristles of the loreal region in *Cathartes* are more numerous than elsewhere on the head.

Spinal tract.—The description of this tract in the California Condor by Miller and Fisher (*loc. cit.*) expresses the condition in *Coragyps* with four exceptions. In *Coragyps* the anterior dorsal cervical region is heavily covered with plumaceous feathers which blend in with the feathers of the ruff. The median apterium in the interscapular region is narrower and shorter. Posteriorly the spinal tract does not narrow down until within 2.5 cm. of the oil gland. At this point it is six feathers wide. Only three feathers are found posterior to this point before the tract ends 0.5 cm. anterior to the base of the oil gland. There are feathers on the midline in the pelvic region.

Coragyps differs from *Cathartes aura* and *Gymnogyps* in having plumaceous feathers in the extreme anterior part of the spinal tract. Also, the apterium between the interscapular areas in the two latter forms is larger than in *Coragyps*. The ruff is much less prominent in *Coragyps* than in *Gymnogyps* and appears to be intermediate between the evident ruff in *Gymnogyps* and the very slight ruff in *Cathartes*.

The postpelvic region in *Coragyps* and *Cathartes* is represented by two or three feathers. Even these are gone in *Gymnogyps*.

Ventral tract.—At the junction of the ventral cervical and the sparsely covered submalar region is an apterium about 1 cm. in diameter. Extending back from this to the level of the shoulders is a narrow strip of semi-plumaceous feathers with plumaceous ruff feathers intermingled. This area corresponds to the median ventral cervical apterium.

The midventral apterium starts about 2 cm. posterior to the shoulder region and extends to the anus. It ranges from 1.5 to 2.5 cm. in width.

Each branch of the sternal region splits lateral to the keel, three rows of

feathers continuing laterally around a sternal apterium and joining the main central tract after a short interval. The two continue together toward the anus in a band of decreasing width. The sternal apterium is not as pronounced in *Coragyps* as in *Gymnogyps*, but it is much more noticeable than in *Cathartes*. In this one specimen of *Coragyps* the apterium on the right side was just visible. The one on the left was approximately 2.5 cm. long and 1.5 cm. wide. Compton did not find this apterium in *Cathartes*, but Nitzsch (*Pterylography*, 1867, p. 51) mentions it. Examination of several skins and one alcoholic specimen of *Cathartes* shows a vestigial apterium. The feathers are farther apart here, and in some cases one or two seem to be missing.

Nitzsch found a prominent insular apterium in *Sarcorampus papa*, a small apterium in *Coragyps atratus*, and faintly visible apteria in *Cathartes* and *Vultur gryphus*. *Gymnogyps* has a very prominent sternal apterium on each side. Thus the sternal apterium is to be found in all the New World vultures but in varying degrees of development.

Caudal tract.—This tract in *Coragyps* in many details corresponds to the cathartid pattern. One difference is that in *Cathartes aura* and *Coragyps* the anal circlet is incomplete, whereas in *Gymnogyps* it is complete and there are one or two incomplete outer anal circlets as in *Coragyps*. *Cathartes* has no outer circlets.

In *Coragyps* I found seven down feathers, 4–5 mm. long, on the oil gland. In the two other forms the gland is completely nude.

Gymnogyps and *Coragyps* agree in having three minor under tail-coverts arranged in a single row. In *Coragyps*, however, there is no indication of an additional series of minor under coverts. Single feathers on either side in *Gymnogyps* may be remnants of such a series. There are six minor under coverts in a single row in *Cathartes*, and laterally a single feather of another series is present.

Patagia at the bases of the rectrices are lacking in all three genera.

Humeral tract.—In *Coragyps* as in *Gymnogyps* there is a prominent apterium between the feathers of the humeral tract and the marginal and lesser coverts. The posterior six or seven rows of feathers in the humeral tract are separated from the coverts in *Coragyps*; five rows are thus separated in *Gymnogyps*. The apterium is hardly discernible in *Cathartes aura*.

Coragyps has one or two more feathers than *C. aura* in each transverse row. Six is the common number. The last row consists of seven feathers, two inner and one outer feather that are small, with four large central feathers. *Gymnogyps* and *Coragyps* are very much alike in this region and differ from most Falconiformes in having six or seven feathers in the transverse rows.

Alar tract.—The arrangement of feathers is the same in the three genera.

There are 11 primaries, 10 greater upper primary coverts, and 11 under primary coverts in each. *Cathartes* has 18 secondaries with 19 upper coverts and 18 under coverts. In *Coragyps* 19 secondaries, 20 greater upper secondary coverts and 19 under secondary coverts are present. *Gymnogyps* has the greatest number of secondaries, 22, with 23 upper and 22 under coverts. Nine tertiaries are present in *Coragyps* and *Cathartes*, but 10 are to be found in *Gymnogyps*.

The claw of the alula is curved in *Gymnogyps* and *Coragyps*, but it is straight in *Cathartes aura*. In my alcoholic specimen of *Coragyps* the claws measure 5.2 mm. and 7.0 mm. On two skins the claws averaged 6.1 mm. in length. Of special interest in the alcoholic specimen of *Coragyps* is the presence of another claw at the end of the second digit. It measures 4.0 mm. on the left and 5.0 mm. on the right wing. On the two skins of *Coragyps* this claw could not be found. Neither could it be found on six skins of *Gymnogyps* nor on a series of study skins of *Cathartes*.

Femoral and crural tracts.—In these three vultures these tracts are so similar that no discussion is necessary. Reference may be made to the other papers cited.

SUMMARY

Coragyps differs in several minor respects from the cathartid pattern as defined in preceding papers. It has feathers on the midline of the pelvic region. Its head is more completely covered with plumaceous feathers than is the head of *Gymnogyps*; *Cathartes* has no plumaceous feathers on the head. There are a few down feathers on the oil gland, but it is not tufted.

Features of importance that are similar in these cathartids include: arrangement of the alar and femoral tracts, lack of patagia around the quills of the rectrices and secondaries, reduction of under tail-coverts, continuous dorsal and pelvic regions and great irregularity of feather placement on the body.

*Museum of Vertebrate Zoology
University of California
Berkeley, California*

FLUCTUATIONS IN NUMBERS OF BIRDS IN THE TORONTO REGION

BY J. MURRAY SPEIRS

THE numbers of any animal species present in a given region fluctuate year by year. In some cases there has been a tendency for the years of greatest abundance to occur at regular intervals. The purpose of this paper is to put on record certain periodic fluctuations which have been detected in the Toronto region, in the winter populations of Northern Shrike, Snowy Owl, American Rough-legged Hawk, Pine Grosbeak, Horned Owl, and Goshawk. In this paper the Toronto region is that area within twenty-five miles of the Toronto city limits. This area reaches to Burlington on the west, to Newmarket on the north, and includes Whitby on the east. The years of greatest abundance will be called peak years, or simply peaks.

The records from which the conclusions presented in this paper have been derived consist of a great mass of data of varying quality. Few of the identifications have been made from collected specimens but with the increased use of binoculars and with the increased quantity and quality of reference books it is no longer necessary to identify birds by collecting them, certainly not for a statistical work where exceptional records automatically play an insignificant rôle. The largest source of data used in this study is the mass of sight records recorded by local bird students.

The chief sources of records are as follows:

1. The file of checking cards in the Royal Ontario Museum of Zoology. These cards list all the species of birds which have been identified in the Toronto region in recent times. Spaces are provided for indicating the number of each species seen on a trip, the locality, the date, the name of the observer, the time spent observing, and the weather. The file contains continuous records since 1885. Records previous to 1920 have been obtained from the diaries of a number of naturalists.

2. The author's records. These consist of daily lists of all species observed, starting from January 1, 1924. Numbers were used in a few cases before 1931 and starting in January, 1931, all the lists have included estimates or counts of the numbers of each species seen.

From these two sources about 10,000 complete daily lists are available and about 3,000 lists that are more or less nearly complete. The number of available daily lists varies from about ten per day in late July to about forty-five per day in early May.

3. These data are supplemented by numerous scattered records in the following sources: the records of the Brodie Club and the Toronto Ornitho-

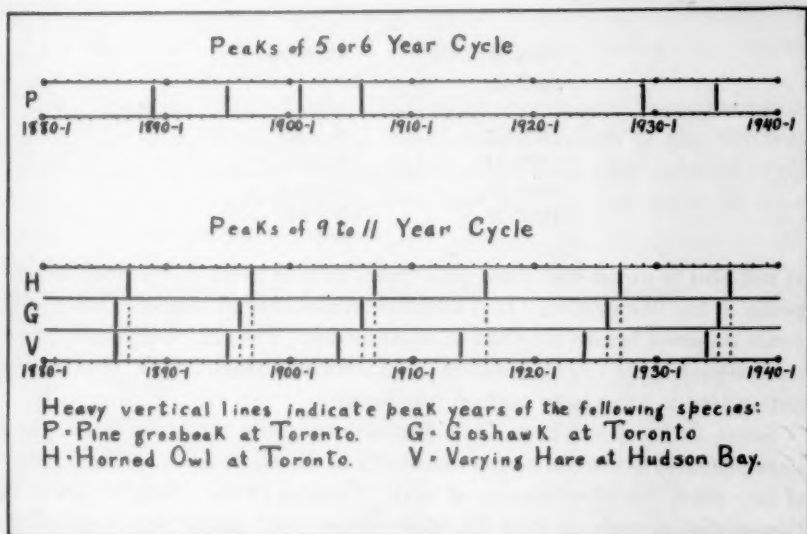
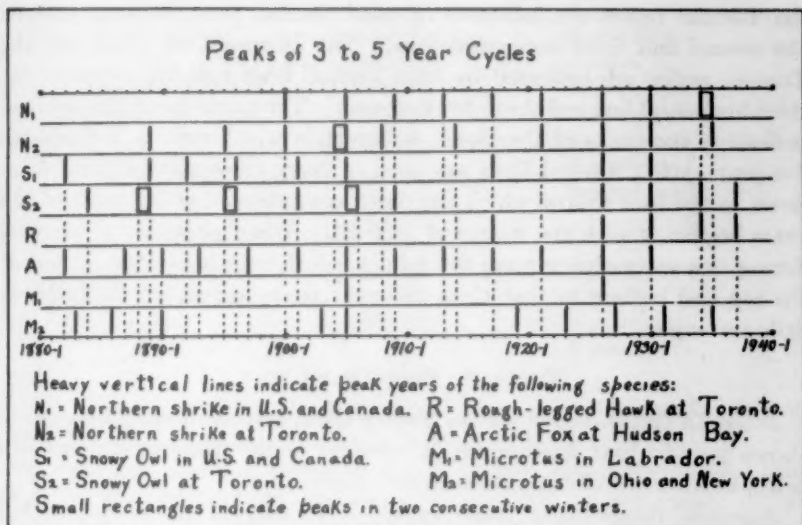
logical Club; specimens in the collections of Mr. J. H. Fleming and the Royal Ontario Museum of Zoology; the literature file of the Royal Ontario Museum of Zoology, in which the ornithological literature is catalogued by species and by locality; the 'Canadian Field-Naturalist'; the 'Transactions' of the Ornithological subsection of the Royal Canadian Institute.

For certain species of birds which winter in the Toronto region these records have been tabulated by years, as is illustrated by the following table for the Horned Owl. From these tables it is possible to pick out certain peak years for each species. These peak years have been indicated on a graph so that the periodicity, if any, might be apparent and so that peaks of different species might be compared.

Periodic Fluctuations of the Horned Owl

Winter of	Records	Winter of	Records
1887-88		1914-15	
1888-89	x, x, 1, 1.	1915-16	
1889-90	1, 1, 1.	1916-17	x, "hundreds."
1890-91	1, 1, 1, 1.	1917-18	1, x, 1.
1891-92	1.	1918-19	
1892-93		1919-20	
1893-94		1920-21	
1894-95		1921-22	
1895-96	1.	1922-23	x, 1.
1896-97	1, 1, x.	1923-24	x, x.
1897-98	x, x, 1, x, 1, 1, "several."	1924-25	1.
1898-99	1, 1, 1.	1925-26	1, 1, 1, 1.
1899-00		1926-27	2, 1, 1, 1.
1900-01	x.	1927-28	1, 1, 1, 1, 1, 4, 2, 1, 2, 1, 1,
1901-02	x.		1, 2, 1, x, 3, 1.
1902-03		1928-29	1, 2, 1, 1, 1, 1, 2, 1, 2, 1, 1,
1903-04			1, 1, 1, 2.
1904-05	1.	1929-30	1, 1.
1905-06	1.	1930-31	
1906-07	1, 1, 1.	1931-32	3, 1, 1, 2, 2, 2.
1907-08	1, 1, 1, 1, 1, 1, 1, "125 shot within 60 mi. of Toronto."	1932-33	
1908-09	x.	1933-34	1.
1909-10	x.	1934-35	1, 1.
1910-11		1935-36	1, 1, 1, 1, 1, 1, 1, 1.
1911-12	x.	1936-37	1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1912-13			1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1913-14	x.		2, 1, 2, 1, 2, 1, 1, "11 shot."

In Text-figure 1 the years of peak abundance of a number of species of birds and mammals are indicated by solid vertical lines. The vertical level at which these lines begin indicates the species to which they refer. For instance in the nine- to eleven-year cycle, the varying hare peaks for the



TEXT-FIG. 1.—Fluctuations in numbers of birds in the Toronto region.

Hudson's Bay watershed are indicated by solid vertical lines running between the time axis and the next horizontal line. The Goshawk peaks for the Toronto region are indicated by solid vertical lines running between the second and third horizontal lines. The Horned Owl peaks for the Toronto region are indicated by solid vertical lines running between the third horizontal line and the upper time axis. The same system is used in indicating the peaks of abundance for animals which exhibit a three- to five-year cycle. Dotted lines are used to carry these solid vertical lines down to the time axis on which the dates are indicated at intervals of ten years beginning with the winter of 1880-81. When peaks have occurred during two successive winters the solid vertical lines have been joined at the top and bottom so that these two-year peaks appear on the graph as little rectangles.

THREE- TO FIVE-YEAR CYCLE

American Rough-legged Hawks, Snowy Owls, and Northern Shrikes have shown year-by-year fluctuations in numbers in the Toronto region, with peaks at intervals of from three to five years.

American Rough-legged Hawk cycle.—It is only in recent years that American Rough-legged Hawk peaks have been recorded in the Toronto region. It will be noted from Text-figure 1 that peaks have occurred during the following winters:

Peak Winters	Intervals
1917-18	
.....	
1926-27	9 years (4+5)
1930-31	4 years
1934-35	4 years
1937-38	3 years

It will also be noted that these peak years have in every case coincided with peaks of the Snowy Owl. It is therefore reasonable to suppose that similar peaks occurred before 1918 but escaped record. The existence of this three- to five-year cycle in the numbers of American Rough-legged Hawks does not appear to have been noticed previously.

Snowy Owl cycle.—The periodic fluctuations in the numbers of this species have probably attracted more attention than the fluctuations in the numbers of any other American species of bird. Fleming (1907) recorded peaks for this species as early as 1833-34, while Gross (1927, 1931) has recorded the Snowy Owl peaks which have been observed in the northeastern United States and Canada since 1876-77. It will be noted from Text-figure 1 that Snowy Owl peaks have occurred during the following winters:

Toronto Region	U. S. and Canada	Intervals
.....	1882-83	
1884-85	.....	2 years
1888-89-90	1889-90	4 or 5 years
.....	1892-93	3 years
1895-96-97	1896-97	3 or 4 years
1901-02	1901-02	5 or 6 years
1905-06-07	1905-06	4 or 5 years
1909-10	.....	3 or 4 years
.....	.....	8 years (4+4)
.....	1917-18	
.....	
1926-27	1926-27	9 years (4+5)
1930-31	1930-31	4 years
1934-35	1934-35	4 years
1937-38	.....	3 years

It will be apparent from the above table that Snowy Owl peaks have occurred at intervals of from two to six years (usually three to five).

No evidence has been obtained which suggests that a Snowy Owl peak did occur in 1913-14. The fact that Snowy Owls did not appear on the 'Bird-Lore' Christmas censuses for that year indicates that this expected peak actually did fail to materialize. The 1922-23 peak, which was not recorded by Gross nor in the Toronto region, may have occurred but the number of owls may not have been sufficient to attract general attention. Snowy Owls were recorded near London, Ontario, during that winter (Saunders and Dale, 1933).

Northern Shrike cycle.—Davis (1937) drew attention to the existence of fluctuations in the abundance of the Northern Shrikes in the northern United States and Canada. Similar fluctuations have been detected in the Toronto region. It will be noted from Text-figure 1 that peaks have occurred during the following winters:

Toronto Region	U. S. and Canada	Intervals
1889-90	.....
.....	
1895-96	.....	6 years (3+3 ?)
1900-01	1900-01	5 years
1904-05-06	1905-06	4 or 5 years
1908-09	1909-10	3 or 4 years
1914-15	1913-14	4 to 6 years
.....	1917-18	3 or 4 years
1921-22	1921-22	4 years
1926-27	1926-27	5 years
1930-31	1930-31	4 years
1935-36	1934-35-36	4 or 5 years

From the above table it will be apparent that peaks of this species have occurred at intervals of from three to six years (usually four or five).

Some other three- to five-year cycles.—Gross (1927, 1931) drew attention to the correspondence of Snowy Owl peaks and peaks of the Arctic fox, the latter based on the Hudson's Bay fur returns. From Text-figure 1 it will be seen that these peaks have agreed very well since 1900, but that prior to 1900 the agreement was poor, possibly due to less accurate records. Davis (1937) drew attention to the coincidence of both of these peaks with peaks of the Northern Shrike. Here again the agreement is evident since 1900 but not before. He also placed on record two peaks of *Microtus* sp.? in Labrador which coincided with the peaks of the Snowy Owl, Northern Shrike, and Arctic fox. These were the peaks of 1905-06 and 1926-27. Hamilton (1937) studying *Microtus* in the northern part of the United States found a cycle which has been of approximately the same length as the cycles of those species mentioned above. An examination of Text-figure 1 will show that his peaks have been decidedly out of phase with those recorded for the other species.

From the above discussion the following conclusions may be drawn. The American Rough-legged Hawk, the Snowy Owl, the Northern Shrike, the Arctic fox, and that form of *Microtus* living in Labrador all have exhibited fluctuations in abundance with peaks at intervals of from three to five years. Since 1900, the peaks of abundance of all these species have agreed very well but before 1900 the agreement was poor, possibly due to inaccurate data. The form of *Microtus* living in the northern United States has exhibited a three- to five-year cycle also, but its peaks have been out of phase with the peaks of the other species. The Rough-legged Hawk, Snowy Owl, and Northern Shrike all live chiefly on mice and other small mammals, yet in 1905-06 and again in 1926-27 they appeared in the south, when according to Davis (1937) *Microtus* in the north was at its peak of abundance. It seems obvious then that these predators did not on those occasions emigrate due to lack of food.

The following alternative explanation for the appearance of large numbers of birds in the south in certain years has been suggested. A peak in the abundance of the food species has resulted in an unusually successful breeding season which has produced a peak population. When such peak populations have come south in late autumn the large numbers have attracted general attention and bird students have received the impression that an unusual migration was taking place. The numbers which came south in years when these species were less abundant were so small that it was not worth while looking for them. As they were not looked for, very few were seen. It is possible also that when the birds became very numerous their migratory tendencies were accentuated (as has been proved to be the

case with certain locusts). This would result in these northern species being seen in great numbers in the south during the winters immediately following an unusually successful breeding season.

FIVE- OR SIX-YEAR CYCLE

Pine Grosbeaks have shown marked fluctuations in numbers in the Toronto region. Peaks have occurred at intervals of five or six years (usually six). From Text-figure 1 it will be noted that these peaks have occurred during the following winters:

Peak Years	Intervals
1889-90	
1895-96	6 years
1901-02	6 years
1906-07	5 years
.....	
.....	23 years (6+6+6+5)
.....	
1929-30	
1935-36	6 years

It will be noted that the peaks during the interval 1910-25 have escaped record. This is not remarkable when the scarcity of observers during that period is considered. The four early peaks were also recorded by Saunders (in litt.) at London, Ontario.

NINE- TO ELEVEN-YEAR CYCLE

Goshawks and Horned Owls have shown very well-marked peaks of abundance in the Toronto region at intervals of from nine to eleven years. From Text-figure 1 it will be noted that these peaks have occurred during the following winters:

Goshawk		Horned Owl	
Peaks	Intervals	Peaks	Intervals
1886-87		1887-88	
1896-97	10 years	1897-98	10 years
1906-07	10 years	1907-08	10 years
.....		1916-17	9 years
1926-27	20 years (10+10)	1927-28	11 years
1935-36	9 years	1936-37	9 years

MacLulich (1937) and Clarke (1936) have demonstrated the existence of similar cycles in populations of the varying hare and the Ruffed Grouse. The Goshawk and Horned Owl cycles for the Toronto region are compared in Text-figure 1 with the varying hare cycle as presented by MacLulich

(1937) for the Hudson's Bay watershed. The figure shows that these cycles are of approximately the same length but that they are out of phase. The Goshawk peaks and the Horned Owl peaks have usually been respectively one and two years later than the hare peaks as recorded for the Hudson's Bay watershed.

Although the Goshawk and Horned Owl peaks have been very conspicuous, at least in the Toronto region, no reference to a nine- to eleven-year cycle in these species has been noted in the literature. Individual peaks have frequently been recorded. Mr. C. E. Hope, of the Royal Ontario Museum of Zoology, who has examined a large number of Goshawks and Horned Owls collected during these flights, states that these birds were in good condition, i.e., that there was no evidence from the birds' condition to indicate that lack of food had caused them to come south into the Toronto region.

Some of the species of birds that have wintered in the Toronto region have fluctuated markedly in numbers from year to year. The peak years for any one of these species have tended to be separated by definite intervals, but variations from this average interval have occurred which have probably been distributed about the average value according to the probability curve. The peaks of abundance of the American Rough-legged Hawk, the Snowy Owl and the Northern Shrike have usually occurred at intervals of from three to five years, while peaks of the Pine Grosbeak have occurred at intervals of five or six years, and peaks of the Goshawk and Horned Owl have occurred at intervals of from nine to eleven years. The peaks have occurred in the years immediately following the maximum abundance of their food in the north. No evidence has been detected to suggest that lack of food drove the birds south.

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Royal Ontario Museum of Zoology
Toronto, Ontario

HISTORY OF ONE HUNDRED NESTS OF ARCTIC TERN

BY OLIN SEWALL PETTINGILL, JR.

ON Machias Seal Island in the Bay of Fundy nest approximately two thousand pairs of Arctic Terns (*Sterna paradisaea*). Of the island's fifteen-acre surface above the high-tide line, only half is occupied by these birds. The remainder of the area is dominated by the lighthouse and whistlehouse, two keepers' houses, and other small accessory buildings. During visits made to Machias Seal Island in the summers of 1932 and 1935 I could not fail to observe the many nesting failures of the Arctic Tern because deserted nests and dead young were noticeable in every section of the island. These failures were particularly puzzling to me for Machias Seal Island seemed to hold environmental advantages far superior to the seabird colonies to the south where high percentages of nesting failures are well known. Machias Seal Island has no wild mammals, not even rats or mice. Few birds of predatory habits visit it during the breeding season. I have never observed there a hawk or owl, raven or crow, and very rarely a Herring Gull. Other nesting seabirds offer the Arctic Terns no serious competition. Because Machias Seal Island is approximately ten miles from the nearest point of the mainland and several miles farther away from the nearest human habitation, because it is separated still further by heavy tides and generally rough sea, and because it is without a port of landing, it has relatively few human visitors. Only the most ardent ornithologists visit it; other persons come only when having some business or family mission at the lighthouse. It rises abruptly from the sea leaving its surface well beyond the wash of even excessively high tides. It has no shifting sands. It is treeless, yet its loose, rocky shore and grassy interior provide shelters of many sorts for the nesting seabirds.

In 1937, I returned to Machias Seal Island determined to study the destructive forces operating here by following the history of a group of nests through the breeding season. Two days after my arrival on July 2, I selected, on the southern section of the island, one hundred nests with eggs still unhatched. I was particular in choosing a group which best represented the entire colony. The nests were adjoining ones; thus a small section of the colony was actually picked for investigation. Each nest was marked by a small wooden slab with one of a series of numbers from 1 to 100. Each slab was placed upright so that it could be seen for a considerable distance. A blind with many lookout holes was securely stationed in the midst of the group of nests so that a large number could be kept under observation at one time. When the eggs hatched, the young were carefully banded. A map of a part of the colony under study was drawn up showing

the location of each nest with reference to neighboring nests and to the geographic features. On succeeding days until my departure on July 28 the nests were methodically visited twice daily, once in the morning and once in the evening. Observations were occasionally made from the blind.

The one hundred nests contained altogether 144 eggs, distributed among the one hundred nests as follows: one nest with three eggs; 42 nests with two eggs; and 57 nests with one egg. *Fifty-three of these eggs failed to hatch.* The reasons for these failures insofar as I have been able to determine them are discussed below.

Ten eggs were stepped on by cattle. The lighthouse keepers, because of their isolation, kept three cows for dairy products. These animals were allowed to graze day and night and at no time were they tied up. They preferred not only the thick grass of the island's interior (a place occupied by buildings and, therefore, without nesting terns) but also isolated clumps of grass among the rocks along the shore where the terns were nesting, sometimes even passing to the high-tide line itself to pluck a few scattered blades.

Eight eggs were punctured by the adult terns. The beaks were used and the contents sometimes removed. I had opportunity to witness from the blind the puncturing of one of the eggs. An adult was seen to alight suddenly beside an unguarded nest and thrust its beak into an egg. The marauder was instantly set upon by several individuals from neighboring nests (possibly also by the owners who may have returned) and was driven away before it could devour the contents. I assumed from the belligerent behavior of the neighboring birds that it was a stranger in their midst, perhaps an unmated bird. The destruction of eggs in the above manner has been observed in other seabirds. Kirkman (1937, pp. 56-57) watched 'outside' Black-headed Gulls 'sucking' the eggs of a close-nesting group of the same species, much to the resentment of the individuals of that group. He did not find gulls within the group, or 'insiders,' sucking one another's eggs. Goethe (1937, pp. 60-62) observed similar egg-destruction among Herring Gulls, and believed that the marauders were unmated birds and certain breeding birds whom the unmated birds introduced to this practice through the taste for broken eggs. The puncturing of eggs was the result of nests being left unprotected for extended periods. While nesting Arctic Terns ordinarily alternate in incubation and so adjust their periods of feeding and incubation as not to leave the eggs unguarded, undetermined circumstances caused certain pairs to absent themselves for intervals as long as 30 to 35 minutes. I noted five instances in which the birds were away from the nests for over 50 minutes.

Seven eggs disappeared from nests. I have no doubt that they were carried away by terns. (Such feats are physically possible by inserting the

bill in the egg and thus gaining a firm hold, either by spreading the mandibles or by grasping the contents.) My belief is supported by the fact that I commonly found, scattered here and there over the rocks, eggs the majority of which were either broken or simply punctured. They were too far from nests to have been rolled to these positions. Probably they were either dropped here from mid-air or taken here to be devoured by marauding terns who had carried away the eggs after puncturing them.

Two eggs, each from a different nest, were found resting outside the nests and deserted while the adult birds continued incubating the eggs remaining in the nests. One egg was only ten inches from the nest, the other twelve. The adult terns had probably pushed the eggs accidentally from the nests but were evidently incapable of rolling them back. While these individual terns lacked the capacity to rescue their eggs, some Arctic Terns and closely allied birds have shown considerable abilities in this respect. For instance, Tinbergen (cf. Kirkman, 1937, p. 216) found two pairs of Arctic Terns that could return eggs four inches from the nest. Hagar (1937, p. 7) reported that the Least Terns, birds much smaller than Arctic Terns, could retrieve eggs if not more than fifteen to eighteen inches away. Kirkman (1937, p. 145) recorded remarkably high percentages of Black-headed Gulls as capable of rolling back into the nest eggs that were nine and twelve inches away.

Two eggs were observed to be carried away partially hatched. In both cases the chicks were nearly clear of their shells. The reason is understandable. Eggshells are removed usually within two or three hours after hatching. Here the instinct seems to have functioned too soon, the eggshells being taken away before the chicks were clear of them. Instances of this sort have been observed in the Song Sparrow (Nice, 1937, p. 145), Hermit Thrush (personal observation), and other passerine birds.

On July 27, the day before leaving the island, the eggs still unhatched were broken open and examined. Eight were sterile, showing no evidence of embryological development. Of these, four were single eggs in the nest. All had been incubated over a period of several days. The remaining fourteen eggs were found to contain dead embryos of which five died in the process of hatching. Desertion is suspected as being the cause of the death of at least two of these embryos and doubtless accounted for the death of several more whose nests had been left uncovered for excessively long periods.

Altogether 91 eggs hatched young of which 23 fledged and probably left the island. *Thus 68 young either met their death in the vicinities of their nests or were lost to the section of the island under study.*

Fifteen chicks ranging in ages from two to nine days died during a severe northeast storm of July 13. Meteorological observations at the nearby

Bowdoin Scientific Station showed the maximum temperature of the day to be 61° F., the minimum 48° F. It was the coldest day during the period when the study was made. It rained rather heavily during the day and there was no sun except in the late afternoon. The wind velocity was twenty miles per hour. Although the storm was well under way at dawn, no chicks were found dead at that time. By nightfall, however, several chicks were found dead in their nests while others died in crevices in the rocks where they had crawled to seek shelter.

For two hours during the morning of this day I watched the portion of the colony under study. I observed several prolonged absences from the nest leaving the eggs and young exposed. In two nests nearby the young appeared to suffer from lack of brooding. But I observed only one marked variation from the ordinary nesting routine: *there was a lack of young-feeding*. Whereas earlier observations showed that the feeding of young birds occurred every five to thirty minutes, at this time only one chick was fed among *all* of those under observation.

I am of the opinion that one of the major causes of death during the storm was starvation due to the inability of the adult birds to obtain food. The day was heavily overcast with a dense fog during the early part of the morning. The roughened surface of the water together with poor visibility probably prevented the birds from seeing and catching their prey. The chicks, not receiving enough food, were considerably weakened and unable to resist the lowered temperature and the severe weather conditions when left uncovered for even short periods. Whitlock (1927, pp. 154-157) has previously observed that oceanic birds are unable to secure enough food during periods of rough weather at sea. After a heavy three-days' gale at Leighton, near Fremantle, Australia, he found in a "semi-exhausted condition" such birds as the Crested, Bridled, Roseate, and Lesser Noddy Terns.

Four chicks which were four, fifteen, seventeen, and seventeen days old respectively, were stepped on and crushed by cows, two being killed during the night. The ability of young terns to 'freeze' on being approached by an 'enemy' appears to have been fateful in these instances. It is surprising that a seventeen-day chick is incapable of escaping from such a death.

Fifteen chicks were found to have met their death in the following ways:

(1) Six chicks were found dead after some form of maltreatment. All were located within two to six feet of their nests. Three showed serious mutilation on the heads and backs while the remaining ones merely showed bruises on the backs of their heads. These six chicks were unquestionably killed by adult terns, presumably those birds owning neighboring nests. This form of infanticide is commonly observed in ground-nesting seabird colonies. Watson (1908, pp. 215-216), in his studies at the Tortugas Islands, was one of the first authorities to call attention to this phenomenon

among terns. He found that chicks of Sooty Tern were attacked by adults still incubating eggs and without chicks of their own. His findings were comparable to mine at Machias Seal Island. Here chicks left their nests to seek shade and shelter in the nearby rock crevices and grass clumps. To reach these they oftentimes had to come near incubating terns and were frequently attacked. If the parent birds were not in the vicinity to come to their defense, the results were frequently fatal.

(2) Three chicks were found dead in their nests. Circumstances led me to believe that they had perished as a result of desertion. Two of the chicks belonged to one nest. They were observed to be noticeably chilled and weak in the evening as if improperly fed and brooded. No adults appeared to protest my presence at the nest or to come down to the nest when I entered the blind for an hour. Early the next morning they were found dead near their nest. Their bodies were stone-cold and there was a deposit of night moisture on their down. The third chick, the sole offspring in the nest, was noticed to be dying one day as a result of lack of care. It was decidedly weak in the morning and was found dead in the afternoon. No adult was seen to pay any attention to the nest during an hour's wait in the blind.

(3) Four chicks drowned in small rain-pools. All were within four days of age. Two, each belonging to a different nest, were drowned in pools formed as a result of the storm of July 13; these chicks died at the beginning of the storm in the night. Adult birds were present at the nests in the morning and several times were observed to attempt brooding in spite of the water in which the corpses of the chicks were floating.

(4) One day-old chick became entangled in a thick clump of grass and was unable to extricate itself. I had difficulty in removing the dead bird, so greatly was it ensnared. The chick had wandered in to seek shelter during the absence of the adults.

(5) Two chicks, two and three days old respectively, crawled too far into the crevices of rocks and became wedged in.

(6) One chick, two days old, fell from the ledge shelf on which its nest was located to a grassy shelf four feet below. The chick died from exposure, as the old birds failed to follow it.

Twenty-nine chicks disappeared during the course of the study at ages ranging from one to eighteen days. I could find no trace of them either among the one hundred nests or in their vicinity. Their disappearance I have attributed to two major factors:

(a) '*Kidnapping*.'—Small chicks were carried away and presumably killed. My assumption is based on one personal observation. While at Machias Seal Island in 1932 I saw one adult bird pounce suddenly upon a newly hatched chick, grasp it in its bill, and fly away with it about twenty-

five feet, then let it drop to its death on the rocks below. The adult paid no further attention to it. Kirkman (1937, p. 117) has watched similar occurrences among the Black-headed Gulls; there are so-called 'rogue gulls' which seem especially addicted to this form of behavior and cause considerable destruction.

(b) *Wanderlust*.—As the chicks advanced in age and the periods between broodings lengthened, many of them were observed to wander from their nests to seek shelter and shade and to hide. Normally there appeared to be a limit to their travels since suitable places could be found nearby. The chicks thus became localized and usually could be found in their vicinities. I became accustomed to looking for certain chicks under a particular clump of vegetation, or in a particular rock crevice. Observations from a blind showed that the adults sometimes brought food to these areas and brooded the chicks there. The chicks which were finally fledged varied little in their wanderings.

I soon became aware of a peculiar phenomenon. Certain chicks, which had up to varying ages been localized, suddenly began to wander and could not be checked. I found one chick over a hundred feet from its own nest; another, fifty feet. These birds I brought back to their territories. The next visits found them gone. From the blind I observed chicks beginning to move away from their nests, not to seek shelter but to keep walking, seemingly "to go somewhere but nowhere in particular." Occasionally they would approach other nesting adults, only to be viciously warded off. Many times I noticed unbanded chicks coming in among the hundred nests and passing on through. One pair of terns on losing their own chicks accepted the offspring in a neighboring nest. The adopted offspring were of the same ages as the ones lost.

The chicks that I observed wandering were obviously uncomfortable. I can only guess at the causes of this behavior. Either they were not being brooded or fed adequately, or both. A similar wandering behavior has been observed in other seabird colonies, but to my knowledge, no satisfactory explanation has ever been given. Herrick (1935, pp. 113-114) has observed that this wandering away from nesting territories is characteristic of young Herring Gulls.

SUMMARY AND CONCLUSIONS

The accompanying table summarizes the history of one hundred nests of the Arctic Tern at Machias Seal Island. A study of this table shows clearly that the greatest loss of eggs and young was due, not to the vicissitudes of the environment of Machias Seal Island (i. e., external factors), but to the various factors arising within the colony itself (i. e., internal factors). The internal factors causing greatest loss may be grouped under the following headings:

(1) *Marauding by adults of nests and young.*—Certain individuals became addicted to puncturing eggs, carrying away eggs, and 'kidnapping' young. Evidence points to the fact that these marauding tendencies occurred in individuals either not mated or not nesting in the part of the colony where the damage was being done.

(2) *Failure of nesting drive.*—Certain pairs of terns failed to incubate steadily, thus exposing their eggs to marauding terns. Others failed to complete incubation, causing the death of embryos. Still others deserted their young, thus either causing their immediate death, or forcing them to wander about on the island with varying results.

The causes of marauding and failure of the nesting drive are open to speculation. The lack of sufficient food in the waters surrounding Machias Seal Island is suspected as being an indirect cause of both marauding and failure of the nesting drive, so that the adult birds are forced to take eggs and young for food purposes and to stop incubation and young-rearing through lack of food for themselves and young. When taking into consideration the fact that there were approximately four thousand adult terns on Machias Seal Island requiring food for themselves *several times a day* and

SUMMARY OF HISTORY OF ONE HUNDRED NESTS OF THE ARCTIC TERN

Record	Number	Per cent
Total eggs in nests.....	144	100
Egg failures due to external factors:		
Cattle.....	10	6.9
Egg failures due to internal factors:		
Rolled from nests.....	2	1.3
Sterility.....	8	5.5
Death of embryos.....	14	6.2
Punctured.....	8	5.5
Carried away at hatching.....	2	1.3
Disappeared from nests.....	7	4.8
Total eggs to hatch completely.....	91	63.
Young killed due to external factors:		
Storm of July 13.....	15	10.7
Cattle.....	4	2.7
Young killed due to internal factors:		
Killed, probably by neighboring adults.....	6	4.1
Deserted.....	3	2.0
Drowned in rain-pools.....	4	2.7
Entangled in grass.....	1	0.6
Wedged in rocks.....	2	1.3
Lost by fall from ledge.....	1	0.6
Disappeared from nests, probably either as a result of kidnapping or wanderlust.....	29	20.1
Young lost to study due to slipping of bands.....	3	2.0
Known total of young to fledge.....	23	15.9

approximately 2500 young during the height of the breeding season requiring food *every five to thirty minutes*, it is wholly possible that there was a shortage of food for such a concentrated population.

Very likely another cause of failure of the nesting drive is its incomplete development in certain individuals breeding during their first, second, and third years. Austin (1938, p. 20) in his trapping and banding studies of Common, Roseate, and Arctic Terns at Cape Cod, Massachusetts, has stated that "egg-laying by a tern the summer following its birth, if it does occur, is anomalous, also that incubation the year following is a precocious and usually futile expression of an incompletely developed sex-urge." He also states "that terns do not begin procreating actively until the end of their third year" and "attain maximum accomplishment in their fourth."

A comparison of the results of this study with the results recently obtained by Hagar (1937, pp. 5-8) in a similar study of the 428 nests of a Least Tern colony at Plymouth Beach, Massachusetts, is of great interest. Both studies showed a high number of egg failures and chick mortalities. Whereas the greatest loss of eggs and young at Machias Seal Island was due to internal factors, at Plymouth Beach the greatest loss was due to two external factors: rats took an estimated 66.5 per cent of the eggs and nearly 50 per cent of the young; storm-tide washes took 19.4 per cent of the eggs. The results of both studies may be summarized thus:

	MACHIAS SEAL ISLAND 100 nests of the Arctic Tern		PLYMOUTH BEACH 428 nests of the Least Tern	
	Number	Per cent	Number	Per cent
Total eggs laid	144	100	820	100
Total eggs hatched	91	63	212	26
Total young fledged	23	15.9	75	9

The above comparison raises the question: If a tern colony is protected from external destructive forces, will there still be a high percentage of nesting failures? The answer naturally depends on the size of the colony and the food supply. The history of the one hundred nests in the *large* colony of Arctic Terns at Machias Seal Island offers an affirmative answer. In the first place there would be an inevitable loss due to the nesting of individuals with an incomplete development of the nesting drive. In the second place there would be sharp competition for food that would by necessity increase the number of nesting failures in the colony.

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*Carleton College**Northfield, Minnesota*

FALL MIGRATIONS OF HAWKS AT HAWK MOUNTAIN, PENNSYLVANIA, 1934-1938

BY MAURICE BROUN

THE dramatic development of Hawk Mountain Sanctuary has been scarcely less spectacular than the fascinating migrations of hawks and eagles that occur there. Hawk Mountain, above Dreherstown in the Kittatinny Ridge of eastern Pennsylvania, formerly a shambles frequented by ruthless local hunters, is now a Mecca to which bird students and conservationists flock in increasing numbers. The Sanctuary has proved itself a compelling force in furthering an intelligent and enlightened attitude toward the birds of prey. Hawk Mountain Sanctuary was an object lesson whose influence and effectiveness induced the Pennsylvania Game Commission in June 1937, to protect all raptors excepting the *Accipiters*, and to remove the bounty on the Goshawk. In the past few seasons, chiefly in the months of September and October, the Sanctuary has been visited by upwards of 12,000 persons who have registered from thirty-one States and several foreign countries; and among the visitors have been many erstwhile hawk-hunters.

In the summer of 1938 the Hawk Mountain Sanctuary Association was formed. The Sanctuary comprises two square miles of rocky woodland, ranging from 550 feet to 1,506 feet above sea level; it is partly in Schuylkill County and partly in Berks County. The property is administered by a board of seven directors. Mrs. Charles Noel Edge is president of the Association, and to her goes all the credit for having been the originator and guiding spirit of the project. The interesting details of the topography, and of the past history of Hawk Mountain may be read in an earlier report (2). The annual reports of the Emergency Conservation Committee contain brief summaries of the Sanctuary's progress as well as a resumé of each season's migration.

I am indebted to Mrs. Charles N. Edge and to Mr. Earl L. Poole for many valuable suggestions.

In the fall of 1934, as a result of the Sanctuary, the migrations of Falconiformes along the Kittatinny Ridge were observed systematically for the first time. However, owing to the necessity for rigid patrol of the Sanctuary during the early part of that season, observations could not always be made, and the migration data, acquired in approximately 306 hours of observation, were incomplete. Since the second season (1935) uninterrupted daily censuses of the hawk flights have been made, each season's observations covering an average of 575 hours. The accumulated data provide a more nearly accurate picture of the migrations than that published prematurely

for 1934 (2), and also furnish a sounder basis for future statistical comparisons. The numerical status of the birds of prey has evoked so much interest among ornithologists, that it seems desirable to make available the data thus far compiled at Hawk Mountain.

The daily censuses have been made as carefully as possible. On some days, however, the birds fly very high, and it is certain that many pass unseen. The totals presented in the monthly tables cannot be construed, therefore, as being all inclusive of the actual numbers of hawks that have migrated over the Sanctuary, or for that matter over the length of the Kittatinny Ridge. It must be borne in mind, also, that prior to 1937 hawk shooting continued to be practiced vigorously at scattered points along the ridge, well up into New Jersey; the shooting has by no means been abolished in spite of the legal statutes protecting most species. How our totals may be affected is conjectural.

The Kittatinny Ridge (and apparently at times the parallel ridges west of it), are essentially migratory flyways for *Buteos* and eagles, and to a lesser extent for *Accipiters*. The hawks coast on the up-currents of air caused by wind striking against the flanks of the mountain, and these air currents provide the *modus operandi* of the ridge flights. The Cape May flyway, as pointed out by Allen and Peterson, is used by the bulk of the *Accipiters*, falcons, Ospreys and Turkey Vultures which breed in the northeastern part of the country (1). Hence, in the table of seasonal totals the figures for these last-named species are negligible. According to reports from the contiguous ridges, appreciable flights of hawks must occur over them on certain days.

General weather conditions have been correlated with the daily flight conditions. The results are comparable, roughly, with those published for 1934, when, it was found, a certain sequence of flights took place, i. e., days of high-flying hawks were followed by periods of stormy weather, which in turn brought heavier migrations of usually low-flying birds (2). It has been found, however, that during protracted periods of perfect weather the birds fly at every conceivable level! During such weather the hawks often fly exceedingly high during the middle of the day, perhaps taking advantage of thermal currents. Suffice it to say—and this is the only thing predictable about the migrations—the heaviest flights are generally preceded by marked meteorological disturbances in the regions to the north. It will be noted in the monthly charts that in most instances from early September until mid-November an appreciable flight of birds occurs at Hawk Mountain within three days of the inception of low barometric pressure moving across the northern Appalachian region. Where the data indicate poor or mediocre flights after a 'low', it does not necessarily follow that no pronounced migration took place. Rain or heavy mists in northeastern Pennsylvania or north-

ern New Jersey may hold up the migrants, or a shifting wind may steer the hawks along a different route. On September 20, 1937, we recorded only 288 Broad-wings in spite of ideal conditions; yet over a thousand of these *Buteos* were observed by Frederic P. Mangels, over Clifton, New Jersey, a locality considerably distant from the Kittatinny Ridge.

Temperature and wind *direction*, at least locally, have no apparent influence on the daily migrations. It is well to bear in mind, however, that the migrating hawks are always seen to best advantage at Hawk Mountain when strong winds strike against the side of the ridge, from *northerly* quarters. It has been suggested by some observers that there is a continuous day-by-day movement, regardless of the weather—the birds simply following the impulse to migrate—but that on pleasant days when the winds are not particularly favorable in creating the proper air currents along the ridge, the birds spread out over the terrain. This presupposes a far greater hawk population than we are aware of. A study of the monthly charts will show many days at Hawk Mountain when ridge flights would appear decidedly unfavorable, so far as wind is concerned, and yet optimum flights have occurred.

Sometimes a day's count is considerably augmented by hawks that evidently have not used the Kittatinny flyway. For example, in the early forenoon of September 16, 1938, groups of Broad-wings came out of the north (at very great height), as though from adjacent ridges, and then proceeded to follow our ridge. On the other hand, there is a tendency for migrants to avoid Hawk Mountain during easterly or southerly winds. Observers at the Sanctuary must occasionally, when the wind is in these directions, strain their vision to the utmost to follow the passage of hawks which leave the ridge to take a short-cut across the valley to a spur of the ridge known as 'The Pinnacle,' some four miles distant. If the birds take this cut too far out they will escape observation altogether. Thus a Golden Eagle observed sixteen miles up the ridge on October 9, 1937—the wind was light south—was not seen at Hawk Mountain. Such instances can be multiplied. The foregoing factors and conditions of the hawk migrations will explain, in part, the widely fluctuating numbers of birds each season.

During September and October, observations are begun about 7.30 a. m. (sometimes earlier), though few hawks venture past the promontories earlier than 8 o'clock. In September, no hawks are seen after 3.30 o'clock except on very good flight days occurring late in the month. A puzzling aspect of the September flights is the invariable appearance of the bulk of a day's migrants between 9 and 11 a. m. Throughout the best part of the season there is usually a lull in the flight during the middle of the day. The flights of October and November are not so uneven. Notable numbers of migrants appear in the afternoons as well as during the forenoons, and on many days

in October the birds migrate until dusk. In November, as the season wanes, the flight duration is from 9.30 or 10 o'clock until 2.30 p. m., never earlier, nor later.

Experiments to measure the speed of flight were made in the fall of 1938, by means of short-wave radio, and by the telegraph system, but both methods failed. Our difficulty with the telegraph was the impossibility of making ground connections, for the terrain is exceedingly rough and rocky. The radio method had various set-backs, chief of which was the perversity of the wind in choosing a southerly quarter each time the trials were made; the oncoming birds, besides, were slow and desultory in movement, and did not stick to the ridge. Further attempts to secure exact data on speed of flight are planned, however, and use will be made of telephone.

In the fall of 1934 I was able to estimate an average speed of 45 miles an hour in Red-tails, by measuring their progress between two points on the ridge. This speed was greatly accelerated on very windy days. An adult Bald Eagle, timed by Mr. Richard H. Pough at Bake Oven Knob on November 10, 1935, passed the Sanctuary twenty minutes later. Assuming this to be the same bird (which from the lateness of the date seems probable), it covered the distance of 16 miles at the rate of 0.8 mile per minute. An adult Golden Eagle, timed by Mr. Pough on October 11, 1936, at Fox Gap in the Kittatinny Ridge, 42 miles northeast of the Sanctuary, was found to make the passage in about 50 minutes—again assuming this to be the same bird—or at a rate of speed almost identical with that of the Bald Eagle.

Assuming an average of six hours of flight on most days (allowing two hours off, from 11 to 1, when there is frequently a lull), and an average hourly speed of 45 miles, it will be seen that the hawks may accomplish 270 or more miles per day easily. Thus, on September 15, 1935, when a pronounced low-pressure area extended over northern New York and New England, the consequent exodus of Broad-wings from that region needed scarcely more than two days to be felt along our section of the ridge, and hence, the impressive totals for the 16th and 17th.

ANNOTATED LIST OF HAWKS

TURKEY VULTURE, *Cathartes aura septentrionalis*.—Throughout the fall a few 'buzzards' may be seen in the vicinity. Individuals, apparently migrating, show up in the second week of September, on good flight days. Only two noteworthy flights, both in 1935, have been observed: a compact fleet of 145 on November 5, and four days later a group of 35 flew by.

EASTERN GOSHAWK, *Astur a. atricapillus*.—In 1934 when the 'Big Blue Darters' were reported as early as October 10, skepticism was manifest in certain circles. Goshawks may be expected along the ridge even in September. The data include seventeen occurrences of Goshawks during that month, the earliest being an immature on September 15, 1937. An adult and two immatures appeared in the big flight of

September 17, 1936. Dr. Sutton cites a number of occurrences of Goshawks in Pennsylvania in September, 1926 (4).

Immature Goshawks are very few in number: 31 (10.6 per cent) in 1935; 15 (8.4 per cent) in 1936; nine were seen in 1937; only one in 1938.

Goshawk 'invasions' evidently took place during the seasons of 1935 and 1936, yet our total of 177 birds for the latter season seems inconsequential when compared with the number of 537 Goshawks that were received for bounty during the month of November alone, by the Pennsylvania Game Commission.

SHARP-SHINNED HAWK, *Accipiter v. velox*.—Of all the hawks this little *Accipiter* is the most difficult to count by virtue of its small size, and swift, erratic flight. When Hawk Mountain was a shooting paradise these were the birds that tested the gunners' skill and provided the most exciting 'sport.' On days of heavy Sharp-shin flights many must escape observation. The birds will appear momentarily, often darting through the trees, sometimes in pursuit of some small bird, and in a flash they are gone.

The Sharp-shin has the longest and most continuous migration of any of the hawks. They come in small numbers in late August or early September, and they increase notably within three weeks. Nearly all these first-comers are birds of the year. One curious exception stands out—on September 22, 1935, every one of 87 Sharp-shins was an adult! The bulk of the September Sharp-shins *always* come during the afternoon. At Cape May they fly largely in the morning (1)! Early October brings a gradual transition from immature to adult birds, and usually by mid-season immatures are seen very infrequently. It is far from easy to differentiate ages when Sharp-shins are moving in large numbers. However, in 1935 and 1936, strenuous efforts were made to obtain such data and it was found that during the former season exactly 50 per cent of the migrants were immatures, while in 1936 only 12.1 per cent were immatures.

Record Sharp-shin days have occurred as follows: 1935—512 on October 2, and 680 on October 4; 1936—901 on October 19; 1937—900 on October 7, and 734 on October 8.

COOPER'S HAWK, *Accipiter cooperi*.—Closely paralleling the Sharp-shin migration—though on a much smaller scale—is the migration of the Cooper's Hawk. As with the Sharp-shin, the immatures precede the adults, and the latter make up the majority of the migrants. October brings the greatest numbers, with 50 to 75 on a good flight day; a record number of 127 was obtained on October 8, 1937.

The proportion of Cooper's to Sharp-shins is roughly 10 per cent—the same figure that holds at Cape May.

EASTERN RED-TAILED HAWK, *Buteo b. borealis*.—Although a few Red-tails appear along the ridge in September (86 represent the maximum number seen in this month, in 1936), conspicuous movements do not occur before mid-October. These *Buteos* travel singly or in pairs, though it is not unusual to see as many as twenty or thirty in a group.

The Red-tail migration is composed predominantly of adults. Age determination cannot be followed consistently, due to the occasional days when the birds fly too high, or too far out from the ridge. A fairly reliable index of the proportion of adults to immatures may be gained, however, from the following table, in which only those individuals are noted whose plumage could be determined.

	Adults	Immatures	Per cent
1934.....	3001	425	14.2
1935.....	3340	460	13.7
1936.....	2641	179	6.7
1937.....	3316	288	8.6
1938.....	1226	181	14.7

The relative scarcity of Red-tails during the fall of 1938 may be explained, in part, by the unprecedented mildness of much of that season; many of the birds may have failed to migrate, or lack of strong northerly winds failed to produce the customary concentrated ridge flights.

A glance at the table of seasonal totals reveals particularly heavy concentrations of Red-tails during the first and fourth seasons. It may be of interest to examine two fourteen-day periods for those seasons.

October														November											
	30	31	1	2	3	4	5	6	7	8	9	10	11	12											
1934—	171	148	592	853	308	5	54	243	25	26	34	99	269	426	—3,253 (232.3 per day)										
1937—	305	985	620	108	460	77	158	305	150	46	80	114	59	55	—3,522 (251.6 per day)										

NORTHERN RED-SHOULDERED HAWK, *Buteo l. lineatus*.—During September of 1935 and 1936 I was much puzzled regarding the exact identification of certain immature plumages of the smaller *Buteos*. Many of these birds were recorded tentatively as Red-shoulders, hence the large recordings of this species in an earlier report (3). Further study has convinced me of my errors in this matter; the questionable *Buteos* have been Broad-wings indubitably. Red-shoulders are actually very infrequent at Hawk Mountain during September (a maximum of 24 was recorded in September 1937), but they appear regularly though in small numbers during October and the first half of November. The migrants are largely adults.

BROAD-WINGED HAWK, *Buteo p. platypterus*.—The data covering five seasons indicate that Broad-wings may be expected at Hawk Mountain in concentrated numbers between September 10 and 26, and that although the Broad-wing has the most restricted migration period of any of the raptors, it nevertheless enjoys supremacy of numbers. In order to convey some picture of the impressive flights of Broad-wings at Hawk Mountain, I can only quote from my field notes some of the outstanding days.

1935, September 17.—“A clear day with light to moderate southeasterly winds. Very soon after my arrival at the lower promontory [at 7.45 a. m.] flock upon flock of small *Buteos* came drifting down the south flank of the ridge. The birds flew very low during the first hour or so of observation; thereafter they were seen at varying levels, sometimes quite high. When the birds reached the ‘kettle,’ having been strung out along the ridge, they would flock up and ascend gradually on the air currents. Milling round and round over our heads until sufficient altitude was gained, they would depart toward the southwest, again strung out in a long line. As many as 50 or 60 birds at a time were in the air above us; once 80 were counted. Mr. Richard M. May, of Hagerstown, Maryland, arriving in the early forenoon, gave his much-needed help in the counting. . . . the busiest period came between 9 and 11 a. m. The migration began to wane about 3.45 o’clock, and a half hour later it was definitely over. The count of 3,293 hawks included about 3,150 Broad-wings.”

1936, September 17.—“Overcast, threatening skies all morning, clearing after 1.30 o’clock; brisk northerly winds most of the day. Small *Buteos* began coming at 8.15

and soon after they were coming thick and fast; I counted 280 between 10.28 and 10.35! The majority passed directly over the ridge within range of shot-gun. [Picture the slaughter in the earlier days!] This flight of low-flying hawks was continuous for five hours. At 12.30 some 150 *Buteos* passed well out over the valley, on the north side of the ridge. Sharp-shins came in numbers after 1.30, as did Ospreys and eagles. At 2.30 I scanned the zenith with my 8-power glasses, just in time to make a hasty count of 200 *Buteos* dashing westward. They were flying so high as to be scarcely visible to the unaided eye. . . . After this the birds flew at varying levels, some very low. There was a steady stream of migrants, a few groups notable as follows: 113 birds at 4 o'clock, 170 birds at 4.08, 126 birds at 4.55, 81 at 5.08, 42 at 5.20. The last hawks seen were 2 Ospreys at 5.47. The count for the day was 3,604 hawks: 1 Turkey Vulture, 3 Goshawks, 92 Sharp-shins, 10 Cooper's, 9 Red-tails, 3,400 Broad-wings and perhaps a very few Red-shoulders, 18 Bald Eagles, 2 Golden Eagles, 8 Marsh Hawks, 52 Ospreys, 1 Pigeon and 10 Sparrow Hawks."

The most remarkable migrations of raptors that it has been my privilege to witness at Hawk Mountain, took place between September 22 and 26, 1938, immediately after the hurricane that devastated New England. These five days were preceded locally by five dreary days of continuous rain.

September 22 brought smiling blue skies and moderate westerly winds. Innumerable warblers were in evidence. The day's count of 918 hawks included 885 Broad-wings of which 700 appeared between 9 and 11 a. m.

The following day, the 23d, produced ideal flight conditions. Only six hawks were seen during the first hour of observation; but 825 were tallied by noon, and the total for the day was 2,062, which included in addition to 1,785 Broad-wings, the following: 187 Sharp-shins, 17 Cooper's, 9 Bald Eagles, 32 Ospreys and 7 Duck Hawks. The birds flew leisurely but in steady numbers, in no very large groups, without any of the customary milling, and the flight continued until 5.20 p. m.

On the third day, the memorable September 24, great numbers of passerine birds rushed past the lookouts. I estimated 100 Flickers, 250 Blue Jays, 400 Cedar Wax-wings, countless warblers and finches, and many Chimney Swifts. Only 40 hawks were seen until 9 o'clock, but thereafter they appeared in swarms: 780 between 9 and 10; 1,120 between 10 and 11; 1,260 between 11 and noon; 530 between noon and 1 o'clock; and diminishing numbers until 4 o'clock, but absolutely no hawks after that hour! The heightened noonday passage of hawks was altogether contrary to our usual experience. At one time as many as 436 Broad-wings were seen in a compact flock. Throughout the morning the Broad-wings flew very low, and in a steady stream on both sides of the ridge—an unprecedented procedure, and not explicable in view of the light northerly wind which ordinarily keeps the birds on the north side of the ridge. The flight was normal during the afternoon, however. The census would have been utterly impossible had it not been for the assistance of a sharp-eyed observer who tallied every hawk that appeared on one side of the ridge. Upwards of a hundred observers witnessed at least a part of this amazing flight. The day's count follows: 13 Turkey Vultures, 185 Sharp-shins (nearly all after 1.30 p. m.), 18 Cooper's, 4,078 Broad-wings, 3 Red-tails, 4 Bald Eagles, 5 Marsh, 9 Ospreys, 1 Duck, 1 Pigeon and 8 Sparrow Hawks, totalling 4,325 raptors.

On the 25th, a surprising early-morning movement of Broad-wings took place. A total of 493 hawks came through between 7.30 and 9 a. m., 287 between 9 and 10, 202 between 10 and 11, and only 381 hawks went by the rest of the day—200 between 3.30 and 4.30. A total of 1,166 Broad-wings was recorded among 1,363 hawks.

The fifth and last day of these phenomenal flights was bright and warm, as were

the previous days; light southerly breezes prevailed. Another huge wave of small birds appeared. All the Broad-wings flew very high, and there was much milling about. Only 18 came by from 8 to 9 a. m., but 662 were counted during the succeeding hour, and 395 between 10 and 11. The Broad-wing count for the day was 1,492.

In this unparalleled five-day period 10,274 hawks were counted, and of these, 9,406 individuals, or better than nine-tenths, were Broad-wings. I venture to state that many, many years may pass before anything comparable to this is repeated.

AMERICAN ROUGH-LEGGED HAWK, *Buteo lagopus s. johannis*.—Excepting the accidental occurrences of the Gyrfalcons, the Rough-leg has proved to be the rarest hawk at Hawk Mountain. An unusually early migrant was identified on October 6, 1935. The meager records extend from mid-October to early December. The exceedingly mild season of 1938 perhaps explains its total absence at the Sanctuary for that fall, as well as its general scarcity over much of the Northeast.

AMERICAN GOLDEN EAGLE, *Aquila chrysaëtos canadensis*.—The astonishing number of 263 Golden Eagles—50 per cent of the total number of both species of eagles—makes up the record for five seasons. These birds have been identified by scores of persons besides myself. It is rather significant that increasing numbers of bird students and field activity taking place in the past few years, have been coincident with a regular epidemic of these supposedly rare eagles, appearing throughout the Northeast.

Adults and immatures alike appear at regular intervals, usually from early October until the end of the migration. Fifteen records obtain for September, the earliest being that of an adult on September 15, 1935. On a number of days as many as four, five, or six Golden Eagles have been seen, while in 1937, nine were identified on October 31, and seven on November 22. Immatures have averaged 50 per cent of the five-year total.

BALD EAGLE, *Haliaeetus l. leucocephalus*.—Early September brings the majority of each season's Bald Eagles. On a few occasions, impressive numbers have been seen, namely, 33 on September 6, and 10 on the 15th, 1935; 11 on the 11th, 18 on the 17th, 1936; 9 on the 23d, 1938. Immatures have averaged 56 per cent of the five-year total.

MARSH HAWK, *Circus hudsonius*.—The 1934 notes concerning this species were inconclusive. During four full seasons the Marsh Hawk has occurred regularly though in small numbers, throughout the period of migration. At Cape May, according to Allen and Peterson, the Marsh Hawk occurs largely in October (1). The largest number of Marsh Hawks observed in one day was 16 on October 26, 1938.

An interesting and undeviating sequence of flight has been observed each season: immatures make up nearly all the September migrants, both sexes as well as immatures come in varying numbers during October, while late in the migration the males outnumber the others. The ratio of immatures to adults has varied seasonally from 33.9 per cent to 48.3 per cent.

	1935	1936	1937	1938
Males	60	42	65	55
Females	35	31	23	42
Immatures	52	72	69	84
Indeterminate	6	4	3	8
	<hr/> 153	<hr/> 149	<hr/> 160	<hr/> 189

OSPREY, *Pandion haliaëtus carolinensis*.—The Osprey is seen almost daily during September, and is particularly well represented on heavy flight days, as is evidenced from the numbers of Ospreys cited under the Broad-wing notes. They occur sporadically in October, as late as the 25th. November records include a bird seen on the 14th, in 1935; another on the 6th, 1937.

WHITE GYRFALCON, *Falco rusticolus candicans*.—The records of 1934 remain unique; nothing can be added to the data already presented.

BLACK GYRFALCON, *Falco rusticolus obsoletus*.—A record in addition to those obtained in 1934 is that of a bird observed on October 16, 1936. The day was overcast; only two other hawks were seen, both Marsh Hawks. To quote from my notes: "At 11.20 I was taken by surprise when a huge falcon in very dark plumage pulled up its sails almost directly above me, and perhaps 70 feet away. The bird's underparts were entirely dark, and its head seemed massive; I noted particularly the long, pointed wings. The bird veered a trifle, hesitated, then sailed off towards the south, moving very slowly, and at a distance of a few hundred feet it dropped low over the trees; unmistakably a Black Gyrfalcon."

DUCK HAWK, *Falco peregrinus anatum*.—The Peregrine plays a minor rôle indeed in the hawk migrations. The five-year records show single birds for the most part, on scattered dates from September 4 to November 23. Very unusual, therefore, were such occurrences as eight birds on October 12, 1936, eleven birds on October 7, 1937, and seven on September 23, 1938.

PIGEON HAWK, *Falco c. columbarius*.—Our data for this little falcon differ little from those for the foregoing species. Earliest and latest occurrences fall in 1935—single birds on September 10, and November 9. In October, 1936, four were recorded on the 11th, six on the 12th, and eight on the 17th.

EASTERN SPARROW HAWK, *Falco s. sparverius*.—All the falcons generally dash past the lookouts at express-train speed, but an occasional Sparrow Hawk may be seen loitering above the ridge, plunging at passing *Buteos*, and twice I have seen them beset eagles. Adults far outnumber the immatures, and the proportion of the sexes has averaged about 65 per cent males, 21 per cent females. Fewer than five individuals ordinarily show up in a day, but 16 were recorded on October 4, 1935; 14 on September 28, 1936; 38 on September 26 and 28 on October 7, 1937; and 17 on September 22, 1938.

TABLE OF SEASONAL TOTALS

Species	1934	1935	1936	1937	1938
1. Turkey Vulture	166	374	87	44	60
2. Eastern Goshawk	123	293	177	49	9
3. Sharp-shinned Hawk	1,913	4,237	4,486	4,817	3,113
4. Cooper's Hawk	333	553	474	492	204
5. Eastern Red-tailed Hawk	5,609	4,024	3,177	4,978	2,230
6. Northern Red-shouldered Hawk	90	181	153	163	143
7. Broad-winged Hawk	2,026	5,459	7,509	4,500	10,761
8. American Rough-legged Hawk	20	9	9	4	—
9. American Golden Eagle	39	66	54	73	31
10. Bald Eagle	52	67	70	38	37
11. Marsh Hawk	105	153	149	160	189
12. Osprey	31	169	205	201	124
13. White Gyrfalcon	2	—	—	—	—

TABLE OF SEASONAL TOTALS—Continued

Species	1934	1935	1936	1937	1938
14. Black Gyrfalcon.....	2	—	1	—	—
15. Duck Hawk.....	25	14	36	41	24
16. Pigeon Hawk.....	19	20	34	10	12
17. Eastern Sparrow Hawk.....	13	123	102	141	87
Unidentified.....	208	23	11	8	—

Totals..... 10,776* 15,766 16,734 15,719 17,024

* Data incomplete; see text.

SEPTEMBER

	1935		1936		1937		1938	
	Daily Totals	Wind Conditions	Daily Totals	Wind Conditions	Daily Totals	Wind Conditions	Daily Totals	Wind Conditions
1							31 * L-NW	
2			3 * L-SE		5 L-W		11 L-N	
3			30 L-N		4 L-W		9 L-SE	
4	— * L-SE		48 L-N		17 * L-W		3 M-NW	
5	— * L-SE		300 M-E		1 * M-NE		38 M-NW	
6	87 B-N		43 L-NW		8 B-E		20 M-E	
7	43 L-NW		23 L-W		103 L-NW		8 * L-E	
8	83 L-W		22 * M-W		110 M-NW		30 M-N	
9	3 * L-SW		87 * M-NW		208 B-SE		9 B-SE	
10	111 B-NW		466 B-SE		40 L-SE		558 M-SE	
11	50 * M-SW		1,228 * M-SE		1 * L-SE		53 L-SE	
12	14 L-W		10 * L-W		36 * L-NW		— * Rain	
13	151 B-E		30 M-SE		— L-NE		33 * M-NW	
14	1 L-SE		1,006 B-SE		76 * M-NW		458 B-SE	
15	307 * B-NW		5 M-SE		130 * M-S		27 * L-NW	
16	729 M-N		767 M-SW		123 * L-S		220 * M-N	
17	3,293 M-SE		3,604 B-N		250 B-NW		11 B-E	
18	97 M-SE		10 B-E		767 * L-W		— Rain	
19	— Rain		166 * B-N		162 * B-NW		— Rain	
20	73 * B-N		— M-E		388 * B-NW		— * Rain	
21	220 L-SW		230 M-SW		79 * L-NW		— * Rain	
22	227 * B-NW		43 L-NW		606 M-SE		918 * M-W	
23	94 * L-N		176 L-SE		1,532 L-S		2,062 * B-NW	
24	292 M-S		13 * L-SE		326 L-W		4,325 L-NW	
25	310 M-W		101 B-N		179 L-E		1,363 M-NW	
26	129 M-W		113 B-SE		299 B-NW		1,606 L-S	
27	30 L-W		43 * M-SW		86 B-E		164 L-SW	
28	— * Rain		158 * M-NW		1 Rain		10 L-S	
29	164 * B-NW		— Rain		44 L-N		60 * M-E	
30	436 B-NW		18 B-E		22 B-SE		95 B-E	
	6,944		8,743		5,603		12,122	

Legend: *—Indicates low barometric pressure in northern Appalachian regions.
L—light. M—moderate. B—brisk. V—variable.

OCTOBER

	1934		1935		1936		1937		1938	
	Daily Totals	Wind Conditions	Daily Totals	Wind Conditions	Daily Totals	Wind Conditions	Daily Totals	Wind Conditions	Daily Totals	Wind Conditions
1	—	—	270 * M—SW		102 * B—NW		47 * L—SE		200	M—NW
2	63	M—SE	688 * B—NW		107	L—NW	101 * M—N		111	L—N
3	34	M—SE	265	B—S	160	M—NW	41	B—E	9	B—E
4	3	M—SE	796 * B—NW		178	L—SE	56	M—SE	4	L—V
5	24	B—E	433 * B—N		84	L—SW	16	L—E	6	L—V
6	—	* Rain	471	B—NW	17	L—SW	46 * M—SW		—	Rain
7	107	B—NW	246	B—NW	4	L—SW	1052	B—NW	22	M—N
8	192	B—NW	50	L—S	—	Rain	951	B—NW	217 *	L—NW
9	80	L—SE	115	M—SE	105	M—E	233	L—S	276 *	B—N
10	31 *	B—E	34	M—S	22 *	M—NW	25	L—SE	362	B—NW
11	257	B—NW	23 *	M—W	545 *	M—NW	343	M—NW	32	L—W
12	369 *	B—NW	106	M—W	688	B—NW	194 *	M—W	111	L—W
13	125	B—NW	132	M—W	92	B—SE	217 *	M—NW	42	L—S
14	258 *	B—NW	34 *	L—W	—	Fog	262	B—NW	9	L—SE
15	255	M—NW	192	B—N	—	Rain	844	B—NW	97	L—SE
16	113	L—SE	26	M—E	3 *	M—S	170	M—NW	42	L—SE
17	9	M—SW	45	L—W	115 *	M—NW	141	L—S	149 *	M—NW
18	535	L—NE	34	B—NW	602 *	B—NW	25	M—SE	50	B—SW
19	189	B—NW	236 *	B—NW	1516	M—NW	—	Rain	22 *	L—W
20	51	M—NW	497	M—NW	409	L—W	100	B—NW	—	* Rain
21	82 *	B—SE	178	B—S	273 *	B—SW	73	M—SW	229 *	M—NW
22	121 *	M—NW	13 *	L—W	292 *	M—SW	76	M—S	180	L—SW
23	571 *	B—NE	1 *	L—W	114	M—NE	3	B—NW	60	L—SE
24	10	M—N	251 *	M—NW	413 *	L—N	77	L—NW	—	* Rain
25	182	M—SE	216	M—NW	602	M—S	82	L—SW	529 *	B—NW
26	20	M—N	521	B—NW	148 *	B—NW	68	M—S	251	B—SW
27	28 *	B—N	139	M—SW	49	L—NE	30	M—SE	285 *	B—NW
28	207	B—NW	195	M—S	110	M—S	—	* Rain	304	B—NE
29	260	B—V	52	M—SE	59	M—NW	473 *	B—NW	93 *	M—NE
30	218	M—NW	3	L—SE	162 *	B—NW	421 *	B—NW	260	B—NW
31	176	M—SW	—	Rain	145	L—NW	1158	B—NW	49	L—NW
	4570		6262		7116		7325		3998	

Legend: *—Indicates low barometric pressure in northern Appalachian regions.
L—light. M—moderate. B—brisk. V—variable.

NOVEMBER

	1934		1935		1936		1937		1938	
	Daily Totals	Wind Conditions	Daily Totals	Wind Conditions	Daily Totals	Wind Conditions	Daily Totals	Wind Conditions	Daily Totals	Wind Conditions
1	641	* B-NW	—	* Rain	53	* L-NW	639	L-S	53	L-NW
2	1013	B-N	722	B-N	1	L-SW	132	* M-S	4	L-NW
3	375	M-S	52	L-SE	94	* B-SW	488	* B-NW	195	M-SE
4	9	* Rain	2	* L-SE	—	Rain	105	L-NW	—	L-E
5	63	L-SW	229	* M-SE	318	* B-NW	186	L-S	15	M-S
6	258	B-N	314	B-NW	53	B-SE	342	* B-NW	2	L-SW
7	27	* B-W	—	Rain	7	L-E	166	L-NW	3	M-S
8	59	L-W	362	* B-NW	—	Rain	57	B-S	35	M-SW
9	39	M-NW	175	M-SE	26	* L-NW	91	B-NW	180	M-NW
10	107	* L-SE	36	L-SE	72	B-NW	143	* M-NW	31	L-SW
11	296	* B-NW	4	* L-SE	59	* L-S	67	B-NW	34	L-SW
12	440	B-NW	—	Rain	1	L-SW	60	B-E	16	L-NW
13	4	* Snow	—	Rain	93	M-N	—	Rain	46	M-SW
14	45	B-NW	66	M-NE	17	L-S	13	* L-NW	53	* B-NW
15	63		—	Rain	9	* B-NW	—	* L-NW	172	M-NW
16	57		8	B-E	19	B-NW	33	L-NW	37	L-NW
17	48		—	* Snow	3	* B-W	—	* Rain	—	L-NW
18	58		172	B-NW	30	B-NW	84	M-NW	—	Rain
19	20		71	B-SE	—	L-W	—	Snow	—	* Rain
20	13		7	* L-S	5	M-W	40	B-NW	26	L-NW
21	—	Rain	27	* L-S	2	* M-NW	46	B-NW	—	L-NW
22	—	Rain	15	* M-NW	10	M-NW	53	B-NW	—	L-NW
23	—	Rain	126	B-NW	2	M-NW	31	B-NW	—	Rain
24	74		101	B-N	—	M-NW	2	M-NW	2	B-E
25	8		33	M-N	—	M-NW	—	L-NW		
26	—	Rain	4	M-N			—	L-SE		
27			1	L-S			—	M-SE		
28			—	Rain			—	Rain		
29			1	B-NW			9	B-NW		
30			5	B-NW			4	M-W		
	3717		2533		874		2791		904	

Legend: *—Indicates low barometric pressure in northern Appalachian regions.
L—light. M—moderate. B—brisk. V—variable.

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Hawk Mountain Sanctuary

Route 1, Orwigsburg, Pennsylvania

HABITS OF WHITE-EARED HUMMINGBIRD
IN NORTHWESTERN MEXICO

BY ROBERT T. MOORE

AN airplane flight from Parral, Chihuahua, to a natural mountain meadow on Mount Mohinora led to the discovery of our first completed nest of the White-eared Hummingbird, recently named by Mr. Griscom *Hylocharis leucotis borealis*. Shortly after sunrise we had climbed to an elevation of twelve thousand feet and were crossing an exceedingly rugged area of sharply contoured peaks and profound canyons. About fifty miles southwest of Parral we caught the reflected sun in a small lake, nestled two thousand feet below us at the base of a sheer cliff. The only body of water observed on the entire flight, it filled a basin in the center of this remote and inaccessible country. Obviously an excellent site for a major collecting station, it was immediately chosen by the author as a future base. Two months later, Chester Lamb made an arduous journey to the shore of this lake, Laguna Juanota, and collected there for an entire month. On August 12, 1937, he obtained the first nest that he had found of the White-eared Hummingbird.

In our six years of zoological explorations in northwestern Mexico we have collected only four nests of this species. Two of these were complete and taken by Mr. Lamb, the third was found on the ground by the author and Arthur Barr, and the fourth had only its foundation laid, when the author discovered it. In his journal Mr. Lamb states that the Laguna Juanota nest was found "in a small oak, six inches in diameter and twenty-five feet tall, growing in a grove of the same on the north hillside of a rocky butte at the lake." It was saddled on a twig among the leafy extremities of a branch two feet from the trunk. The nest is composed almost entirely of a buff-colored plant-down, the only exceptions consisting of one small oak twig woven loosely to the bottom of the nest and greenish-gray lichens ornamenting the exterior portion. Measuring 1 by $1\frac{1}{8}$ inches on the inside, it has no other lining except the plant-down. The outside measurements are $1\frac{7}{8}$ by $1\frac{1}{2}$ inches. It contained one fresh egg, now with the nest in the Moore Collection.

The second nest was found May 23, 1938, lying on the ground among pines and oaks of Rancho Batel at the top of a mountain range, where it reaches 6,300 feet elevation in southeastern Sinaloa; apparently it had been attached to a limb of the oak tree above it. It resembles closely the first nest, except that two oak catkins have been woven into the sides and the lichen decorations are more abundant. In spite of the fact that it is twice as large as the Laguna Juanota nest, I have no doubt as to the identity, be-

cause a much larger nest, to be mentioned later, was positively identified as belonging to this species. I have seen the nests of no other hummingbird in northwestern Mexico, which in the smaller sizes so closely resemble that of the eastern Ruby-throat.

At first glance, nest number three differs extraordinarily from the previous two. Its total bulk is nearly five times that of the first nest, and four times that of the second, and yet the length and width inside are as small as the first two, namely 1 by $\frac{11}{16}$ inches. The internal depth, however, is almost twice as great as that of nest number one. The external measurements are: length, $3\frac{1}{8}$; width, $2\frac{1}{4}$; and depth, $2\frac{1}{8}$ inches. Furthermore, the construction of the external part of the nest is almost totally different, consisting of a fine green moss and having pine needles, dried twigs and four or five small leaves, as well as a few lichens, woven into the external structure. Nevertheless, close examination proves that the two chief characteristics of the Laguna Juanota and Batel nests are present, namely, use of buff-colored plant-down for the bulk of the structure and oak-lichens for external ornamentation. There is no evidence whatever that this is a double nest. Fortunately the female parent was collected as it flew to a nearby bush, as was the female of nest number one, and identification of both is positive. This large nest was taken at Nievero, four miles west of Ciudad, in western Durango on March 26, 1938.

It is quite probable that the environment of the nest-site had a great deal to do with the type of construction. This moss-covered abode was placed on a small shrub, growing out of rocks four feet up from the base of a cliff in a very dark and deep arroyo. In such a place much moss is available, whereas lichens are difficult to find. Three nest-sites so dissimilar could hardly have been chosen as those of these three structures—an oak tree on the very highest point of a wind-blown mountain range, a cliff jutting out on the shore of a wind-protected small lake, and the bottom of a deeply shaded gorge! Dissimilarity of nesting period is also indicated, March, May and August!

The foundations of a fourth nest were found by the author on Mount Mohinora at 10,500 feet elevation on May 18, 1937. Cobwebs were being woven about the crotch of a plant stalk in a great field of flowering paintbrushes, which flamed for two hundred yards under the moss-hung limbs of oaks and pines. This was actually the first one discovered by our expeditions.

The Nievero nest contained two white eggs, one on the point of hatching and the second infertile, which is now in the Moore Collection. It measures 12.1 by 7.9 mm. Oblong in shape, it is very different from the more spherical egg, measuring 11.6 by 8.2 mm., of the Laguna Juanota bird.

Although the nests were all taken at high elevations, 6,000 feet, at Nievero,

and 10,500 feet at Mount Mohinora, the large series of birds in the Moore Collection has been secured from a much wider range of altitude. The Moore Collection contains 113 specimens from all parts of Mexico, but the majority of them have been obtained in Sinaloa, Chihuahua, Durango and Nayarit. The highest elevation is recorded for one collected by the author on Mount Mohinora at 10,500 feet, and the lowest for specimens secured by Mr. Lamb near the city of Tepic, Nayarit, at about 3,000 feet. The author also took one at the latter altitude on the Urique River at the bottom of the great Barranca del Cobre on May 17, 1934, where the temperature was decidedly hot and sultry. This last was in a definitely arid cacti association, where the leaf of every tree was burned brown by the long-continued dry season, but, except for these isolated cases, no other specimens have been obtained below 4,000 feet in altitude. Certainly the open fields and meadows near Tepic are below the Transition Zone, but on the other hand the general locality is not nearly so arid as the bottom of the great canyon in southwestern Chihuahua.

Wherever I have been in the mountains of northwestern Mexico above 5,000 feet, the White-eared Hummingbird has been the most common of all the Trochilidae and the dominant bird of its family in relation to other species. At the lower border of the Transition Zone up to an altitude of 6,500 feet, it frequently finds itself in the company of the Calliope and the Broad-tailed. At the lower level the much rarer Margaret Hummingbird (*Atthis heloisa margarethae*) occasionally appears at a common food-tree. This level also marks the upper habitat of the Violaceous Hummingbird (*Saucerottia beryllina viola*), but I have never noticed this bird conflict with the White-ear. At the higher levels of the Transition Zone and lower Temperate Zone where great patches of paint-brush sweep down the mountain slopes among pines and oaks, the White-ear comes in contact with such typical Transition Zone species as the Rivoli and the Blue-throated. Here, too, the more ubiquitous Broad-billed Hummingbird is common. But in whatever altitude and in whatever group of associates it is found, whether smaller or larger, the White-ear maintains control of the food-flowers it prefers.

In April 1936, the author spent several days at Rancho Batel in southeastern Sinaloa photographing with kodachrome film, four species of hummingbirds, which were feeding from the flowers of one large shrub at an altitude of about 6,000 feet. Approaching the proportions of a tree, this remarkable shrub, twenty feet in height and of the same width, was completely covered with globe-like clusters of grayish-lavender blooms. Counting the flowers in one area and making an average for the tree, I reached the surprising total of forty thousand individual flowers. At no time from sunrise to sunset were there less than four hummingbirds in this tree. Often

there were as many as twenty consisting of four different species, the White-eared, Broad-tailed, Calliope and Margaret Hummingbirds. The White-ears, like irascible knights of the air, were always ready to thrust lance at an assumed affront. It made no difference whether it was the tiny Margaret or the larger Broad-tailed, some White-ear would dive viciously at any intruder who dared to approach too close. The Broad-tailed Hummingbird, heavier and more powerful, would dart into the tree with direct flight and pompous hum, but its assurance would be quickly dispelled! A male White-ear would immediately launch an assault and drive the larger bird up the mountainside in ignominious retreat.

The same dominance was exhibited on several afternoons in May 1937, when I visited the mammoth paint-brush beds on the slopes of Mount Mohinora at the 10,000-foot level. Here the White-ears outnumbered all the Broad-billed, Blue-throated and Rivolis together. In one of these astounding fields of color, perhaps a hundred yards long and a hundred feet wide, a dozen White-ears were feeding at one time. If one of the other larger species dove into the flower masses, even if at a point far removed from the nearest White-ear, one of the latter would immediately whirl to the attack and drive the Rivoli's and Blue-throated Hummingbirds, twice their size, into headlong flight. During the drowsy hours of mid-day, the White-ears would cease feeding and rest quietly at various points among the oak trees, generally choosing some spot in the shade. Should a Blue-throated or Rivoli choose this propitious moment to glide quietly into the flower beds, the nearest White-ear would come to life and volplane down in a surprise attack. Not once out of many hundred times, did I observe any of these three other species attempt to resist. It might seek some other point in the large mass of flowers, but the White-ear invariably pursued until the other bird had left the food-area.

The wing-action of the White-eared Hummingbird I compared with that of the Calliope and the other species at Rancho Batel in 1936. Its wings beat slower so that, when poising in front of a flower, they are not an indistinguishable blur, as in the case of the Calliope, but there is a slightly visible wing stroke. Possibly because of this slower wing stroke, as well as the heavier longer body, the rear end of the bird gradually drops as it continues to poise in front of the flower. If it feeds continuously from one cluster of small blooms, a curious rhythmic, but irregular motion of the tail up and down is created. At first the tail is horizontal and in the same plane with the body. When the tail begins to drop, the bird, in order to compensate for the increasing lack of balance, forcibly lifts it into the air. Timing these vertical beats, I found they averaged three to the second. At first I thought this downward and alternate upward sweep of the tail was for the purpose of moving the bird from one flower to another, but this was not the

case. I never observed the Calliope or the Margaret Hummingbird doing this.

In spite of the pugnaciousness of the White-ears, they are also the shyest of the four species at Rancho Batel. At the large flowering shrub, mentioned above, where I observed them for hours at a time, the Calliope Hummingbird was the tamest and the Broad-tailed next. I was often able to photograph these latter birds with a moving-picture camera at a distance of six feet, but I seldom could get this close to a White-ear. As a rule it would move to the opposite side of the tree, if it did not depart entirely, when I began starting the motor of my camera.

The call-note of the White-eared Hummingbird is exceedingly high-pitched and sharply staccato. On one occasion in April at Rancho Batel, I was favored by a performance within a few feet of my head. The male repeated its call-note about ten times in each phrase and did it so often that it was easily possible to get the exact note on my pitch-pipe. It might be rendered musically as follows:



California Institute of Technology
Pasadena, California

REDISCOVERY OF *HELEODYTES CHIAPENSIS* AND
TANGARA CABANISI

BY PIERCE BRODKORB

DURING the summer of 1937, while collecting birds in the State of Chiapas, southern Mexico, I had the good fortune to secure seven specimens of *Heleodytes chiapensis* (Salvin and Godman) and a single skin of *Tangara cabanisi* (Sclater). Both of these so-called 'lost species' had previously been known only from the unique types collected many years ago.

Heleodytes chiapensis was described in 1891 from a specimen obtained at Tonalá, Chiapas, by W. B. Richardson. It was not again mentioned in the literature until the third volume of Ridgway's 'Birds of North and Middle America' appeared in 1904. Ridgway had to content himself with a quotation of the original description, since he had not seen the type in the British Museum. He stated, however, that it was unfortunate that the describers did not point out any characters by which *chiapensis* could be told from the races of *H. rufinucha*. When Hellmayr came to treat the wrens in his 'Catalogue of the Birds of the Americas' in 1934, he also had not seen the type of *chiapensis*. For this reason Ridgway's statement misled him into considering *chiapensis* identical with *Heleodytes rufinucha nigricaudatus* Nelson. Since *chiapensis* was of earlier date than *nigricaudatus*, he employed the combination *Heleodytes rufinucha chiapensis* (Salvin and Godman) for the Chiapas race of *rufinucha* with *nigricaudatus* Nelson as a synonym. Within the last few months, however, van Rossem has examined the type of *chiapensis* in London and states that it is specifically distinct from *Heleodytes rufinucha*, although he, too, fails to mention characters by which the two birds can be told apart.

My series of four adults and three birds of the year was taken between June 27 and July 27, 1937, at Finca Esperanza, a coffee plantation inland from the town of Escuintla in the District of Soconusco, Chiapas. A comparison of these birds with specimens of *Heleodytes rufinucha nigricaudatus* shows at the first glance that the two are specifically distinct. In the first place *chiapensis* is much larger, being about twice the bulk of *rufinucha*. In *chiapensis* the pileum and hind neck are entirely black, and this color even extends down on to the upper portion of the back; in *rufinucha* only the pileum is black, and the hind neck and upper back are chestnut in color. The remiges of *chiapensis* have only small imperfect bars which are confined to the outer webs, with a faint trace of dusky barring on both webs of the tertials in fresh plumage. The wing-coverts, back, and upper tail-coverts are plain chestnut. The whole effect is of a plainly colored unbarred bird. The forms of *rufinucha* are heavily barred with blackish and buffy on the

wings and upper tail-coverts, and the barring even encroaches to some extent on the lower back. In *rufinucha*, moreover, the ground color of the tail is black, while in *chiapensis* the tail is mainly russet with narrow bars of dusky.

I found *H. chiapensis* in a variety of habitats at Esperanza. It occurred in the rain forest, where family groups were wont to clamber in and about the vines festooning the trees. At other times its loud ringing song was heard from thorny hedgerows surrounding a pasture which had been cleared from the forest. It was even seen upon occasion about the buildings of the patio at Esperanza, and a not infrequent sight was one of these birds poking its head inquisitively out of the chicken coop, where, I was told, it came to suck hens' eggs. This alleged habit has given the bird its local name, 'chupa huevos.'

By June 27, the first day spent in the field, the young of the year were already full grown, although still retaining the soft fluffy feathers of immaturity on the crissum. The adults at this time were badly worn: the throat was almost bare, and the wings and tail were much abraded. The last adult specimen was collected on July 20, when a complete molt was commencing.

My specimens of *chiapensis* were all taken in the Humid Tropical Zone at 500 feet elevation. I did not find *Heleodytes rufinucha nigricaudatus* at Esperanza, although it did occur at Escuintla and at Colonia Soconusco, only a few kilometers away, but at lower altitudes (elevation 100 to 200 feet) and in a different life zone, the Arid Tropical, instead of the Humid Tropical. The annual rainfall at Esperanza is about 110 inches. Precipitation is much less on the coastal plain where *nigricaudatus* occurs.

For the sake of completeness, I append the synonymy and description of this wren.

HELEODYTES CHIAPENSIS (Salvin and Godman)

Camphylorhynchus chiapensis Salvin and Godman, Ibis (6) 3: 609, October, 1891 (Tonalá, Chiapas; type in British Museum).—Dickey and van Rossem, Publ. Field Mus. Nat. Hist., zool. ser., 23: 431 in text, March 21, 1938 (crit.).

Heleodytes chiapensis Ridgway, Bull. U. S. Nat. Mus., no. 50, pt. 3, 504, 1904 (crit.).—van Rossem, Bull. Brit. Ornith. Club, 59: no. 416, 10, November 17, 1938 (crit. and meas. type).

Heleodytes rufinucha chiapensis Hellmayr, Publ. Field Mus. Nat. Hist., zool. ser., 13: pt. 7, 145, 1934, part (as to type only).

Postocular stripe, pileum, and hind neck blackish brown (fading to more brownish in worn plumage), the black extending on to the upper back, where gradually merging into cinnamon russet of back and upper tail-coverts, the latter occasionally with the faintest indication of dusky cross-bars; rump occasionally with concealed dusky-bordered small white spots; remiges dark brown, all except the outermost primary edged with cinnamon russet, the edgings increasing in extent on inner flight feathers and usually broken by narrow indistinct bars of dusky; tertials wholly cinnamon

russet, crossed by narrow indistinct dusky bars; primary coverts blackish, narrowly edged with cinnamon russet; remaining wing-coverts plain cinnamon russet like back, but the greater coverts more or less suffused with dusky like upper back; central pair of rectrices dull russet, with rather indistinct narrow dusky bars; remaining rectrices blackish brown, edged with dusky-barred russet on outer web, and with a broad oblique subterminal band of white (rather buffy in fresh plumage) on both webs, except on second pair from inside, where confined to inner web; outer pair of rectrices similar, but mottled or irregularly barred on outer web with dusky, russet, and buffy; lores pale dusky; superciliary stripe, auricular region, sides of neck, and entire under parts, including under wing-coverts and axillars, plain white, changing to pinkish buff on flanks and to cinnamon-buff on crissum, on which parts some of the feathers have a dusky streak or bars along shaft; thighs buffy, with a patch of russet or dusky or both on heel joint; bill (in skin) blackish, horn color on lower surface of basal portion of mandible; feet grayish brown.

The sexes are alike, and the young differ only in having the superciliary stripe more buffy. An immature male collected on June 27 weighed 49.6 grams.

Measurements (in millimeters) of adults are as follows:

	Wing	Tail	Culmen from base	Tarsus	Middle toe
♂.....	93	82	29.5	33	21
♂.....	93	83	28	30	20
♂.....	93	83.5	31	30	20.5
♀.....	88	78.5	29	30.5	20.5
♀ (type) ¹	85	74	26.1	29	19

¹ Ex van Rossem; bill measurement is of exposed culmen.

My specimen of *Tangara cabanisi*, an immature female, was taken at an altitude of 5,500 feet on Mount Ovando, near Escuintla, Chiapas, on August 29, 1937. I shot it from the top of a tall tree on the edge of a small clearing in the cloud forest. It was alone, and no others were seen subsequently although a thorough search of the vicinity was made during the next week. As this is the first example to be taken since the original specimen was collected over seventy years ago at Costa Cuca, Guatemala, it is exceedingly unfortunate that both the type and my bird are immature. My specimen is duller than Sclater's figure of the male type (Ibis, 1868, pl. 3) and has much less blue on the pileum and shoulders, which are largely gray. The auricular region in my bird is dusky with grayish shaft-lines, instead of being the greenish yellow of the plate. There are only a few blackish subterminal spots on the upper breast, which is marked by dusky shaft-lines. The flanks are tinged with pale blue, not yellowish green. The measurements are somewhat smaller than those of the type as given by Hellmayr (Cat. Birds Americas, pt. 9, 139, note, 1936) namely: length in flesh, 157 mm.; extent, 265; wing, 82; tail, 53.5; culmen, 11; tarsus, 19; middle toe, 13. My bird had the skull unossified and was undergoing a body molt. Its soft parts were colored as follows: iris dark brown; bill dusky horn, whitish at

base of lower mandible; legs and feet blue-gray (brownish in dried skin) with orange soles.

It is interesting to note that Salvin and Godman predicted that this species might eventually turn up in Chiapas.

Museum of Zoology, University of Michigan
Ann Arbor, Michigan

STORM MORTALITY IN A WINTER STARLING ROOST

BY EUGENE P. ODUM AND FRANK A. PITELKA

REPORTS of large-scale mortality among birds resulting from severe weather conditions are frequent in ornithological literature. Kendeigh (Ecolog. Monogr., 4: 342-352, 1934) summarizes a number of these, pointing out the environmental factors concerned. However, accounts of avian catastrophes do not often include attempts to determine the amount of mortality or to measure the causal factors. The ultimate value of records of such incidents can be much augmented by accompanying them with accurate climatic and habitat data. The present report is concerned with mortality among roosting 'blackbirds' at Urbana, Champaign County, Illinois, during a regional rain and wind storm on the night of February 9, 1939. Additional data were obtained after subsequent shooting into the roost on February 25-26, and March 3 or 4, 1939.

The Roost.—During recent years, swarms of 'blackbirds' have roosted in the northern half of a thirteen-acre grove, locally known as the 'forestry,' planted seventy years ago on the south campus of the University of Illinois. The tract is surrounded by more or less open country on south and west sides. Usually the birds massed in a belt of white pines on the northwestern side, but sometimes a part of the flock settled to the east in deciduous trees which are sheltered from prevailing winds by the pines. The density of white pines is about 250 per acre, that of deciduous trees (chiefly green ash) somewhat less; undergrowth is entirely absent.

During the winter of 1938-39, to the best of our knowledge, four species were represented in the roost: Starling (*Sturnus vulgaris vulgaris*), Cowbird (*Molothrus ater ater*), Bronzed Grackle (*Quiscalus quiscula aeneus*), and Red-wing (*Agelaius phoeniceus* ssp.). The latter three species usually occur in central Illinois in small numbers throughout the winter. The number of birds occupying the roost at the time of the storm was estimated at 25,000. Of these probably not more than 3% were cowbirds and grackles. Red-wings, of which only a few individuals were present, were not represented in the mortality.

Storm Mortality.—On the morning of February 10, following the storm, dead birds were found on the ground over most of the roosting area and also to the east, northeast, and north—even to a distance of several blocks in these directions. In exposed places and on the windswept 'forestry' grounds, the carcasses were frozen hard to the ground. They were most numerous in the peripheral areas of the roost in the directions mentioned. Actual counts made by the writers are as follows:

Starling.....	570	78.5%
Cowbird.....	93	12.8
Bronzed Grackle.....	63	8.7
Total.....	726	100.0%

The grackles and cowbirds were found chiefly under a small group of tall Norway spruces somewhat apart from the main roosting site in a seemingly more protected location. A number of crippled Starlings, at least twenty-five, were observed during the counting. Eight white pines and six or seven deciduous trees were down as a result of the storm.

The total mortality as a result of the storm exceeded the figure given since dead birds were scattered widely beyond the roost chiefly to the east and northeast, but it probably did not pass 1,000. While this is only an approximate 4% of the roost, it is appreciable enough to warrant investigation especially since accurate weather data are available.

Post-Storm Roost Composition.—The proximity of the roost to habitations having proved objectionable, shooting into the roost was carried on on February 25 and 26, causing the birds to shift to evergreens in a cemetery south of the University campus, where further shooting was done on March 3 and/or 4. The counts following the shooting can be regarded as random samples, and the percentages given are believed to be representative of roost composition after storm mortality.

(Dates of shooting)	February 25-26		March 3-4	
Starling.....	631	97.1%	361	98.6%
Cowbird.....	9	1.4	3	0.8
Bronzed Grackle.....	8	1.2	2	0.6
Red-wing.....	2	0.3	—	—
Totals.....	650	100.0%	366	100.0%

The cowbirds and grackles in the second shooting are believed to be remnants of the wintering population since no northward migration of early spring birds was detected up to these dates, a point which seems to be supported by the relative constancy of the sex ratio (approximately 2♂:1♀) among the Starlings over the week period (February 25–March 4) during which initial shifting and migratory movements might have been expected.

Number examined.....	112	361
Males.....	77 (68.7%)	232 (64.3%)
Females.....	35 (31.3%)	129 (35.7%)

The variation in sex ratio is comparable to that found by Hicks (Bird-Banding, 5: 103–118, 1934) during the same period in an extended study of Ohio Starling roosts.

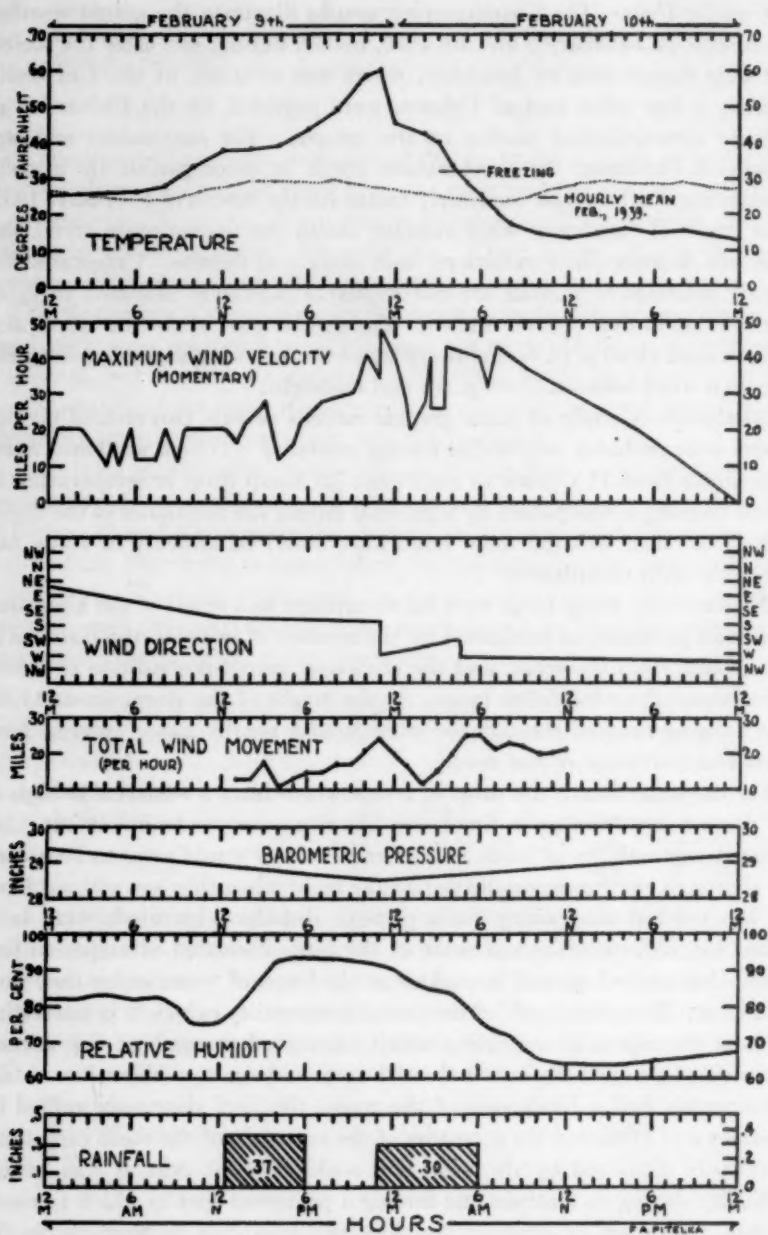
Weather Data.—The accompanying graphs illustrate the actual weather conditions on February 9 and 10, 1939, before, during, and after the storm. All data except relative humidity, which was obtained at the University Woods, a few miles east of Urbana, were provided by the University of Illinois meteorological station on the campus. For comparison and emphasis of extremes, the temperature graph is accompanied by a daily fluctuation line based on the hourly means for the month of February, 1939. The graph of maximum wind velocity shows the approximate trend and does not include minor variations from minute to minute. Unfortunately, hourly readings of rainfall are not available; however, amounts together with period of duration are shown. The greater part of the 0.3 in. of rainfall between 11.00 p. m. on February 9 and the following morning fell during the high wind between 11.00 p. m. and midnight.

Analysis.—A study of these graphic records reveals two critical periods which were probably responsible for the mortality: (1) high wind and warm rain storm from 11 o'clock to midnight; (2) sharp drop in temperature to below freezing accompanied by high wind during the remainder of the night. Which of these was the more important would be difficult to state, but probably both contributed.

Undoubtedly many birds were killed outright as a result of the high wind (48 miles per hour) as evidenced by the number of cripples, the distance of some birds from the roost, and the obviously mangled condition of others lying about the wind-fallen trees. At the height of the storm about 11.30, one Starling crashed through the window of a nearby house (several hundred feet northeast of the roost).

On the other hand, the drop in temperature from a remarkable high of 60° F. to below freezing in five hours likewise seems to be important. Increased vulnerability of birds to low temperatures would seem to be caused by thorough wetting especially during the night when they are without food. It was evident that many birds perhaps dislodged by wind, were later killed by cold. Positions of some of the birds indicated attempts to find protection under logs and in pockets at the bases of trees, where they died and froze. From this angle of the probable mortality causes, it is interesting to note the report of a Starling which attempted to roost on the warmer inner sill of an opened window about 1 a. m. and again at about 3 a. m. approximately half a block east of the roost; the bird vigorously ruffled its feathers and attracted the attention of the occupant of the room each time. Obviously dislodged by the wind and soaked by the rain, it was having difficulty drying its feathers and finding a protected spot in which to roost.

The proportion of Bronzed Grackles and Cowbirds to Starlings in the total storm mortality was certainly much greater than that in the total roosting flock as indicated by observation and especially by results of later



TEXT-FIG. 1.—Graphic representation of specific climatic data coordinated on the same time scale, correlating possible factors involved in mortality of birds during storm period.

shooting (an average 2% cowbirds and grackles from random sample shooting as compared with 21.5% killed in the storm). This together with the fact that the grackles and cowbirds were roosting in a more protected spot would indicate a differential mortality among the three species, these two being considerably less resistant and dying in proportionally greatest numbers. Several grackles and cowbirds were frozen in the Norway spruces (see above) without having fallen to the ground, and the greater number of them were lying directly below the evergreens, indicating that they had fallen out rather than been blown out.

SUMMARY

1. A 'blackbird' roost was subjected to a driving wind and rain storm from relatively unprotected southwest and west sides.
2. The wind reached a maximum velocity of 48 miles per hour and was followed by a sharp drop in temperature and continued high wind.
3. The destructive combination of weather conditions occurred when a warm southeast wind suddenly shifted to the southwest and west.
4. A mortality of approximately 4% resulted in the 'blackbird' roost, the size of which was estimated at 25,000 birds.
5. A differential mortality among the species of the roost was apparent; the proportion of Grackles and Cowbirds to Starlings in the total mortality was considerably greater than that in the total roosting flock.

Conclusions.—In an analysis of storm mortality, the time of occurrence, intensity, duration, and relation of specific weather factors must all be considered. Such examination of weather records provides a basis for more accurate judgment of the causes of mortality than can be made from simple observation alone. Furthermore, comparisons with records of subsequent severe storms can be made; these may reveal more clearly the factors most critical to winter roosting flocks.

The writers wish to express thanks to E. J. Koestner and C. T. Black for assistance in making counts of birds; to Mrs. D. H. Mills, J. M. Speirs, F. C. Bellrose, and M. J. Feldman for confirmatory counts; to Mr. H. P. Etler of the University of Illinois Meteorological Station for kindnesses in making weather data available; and to Mr. R. W. Lorenz of the Department of Forestry, University of Illinois, for data on the tract occupied by the roost.

*Experimental Zoology Laboratory
Champaign, Illinois*

FEEDING BEHAVIOR OF A NORTHERN SHRIKE

BY WILLIAM MONTAGNA

ON FEBRUARY 25, 1938, Doctor Fraser, Professor of Plant Breeding at Cornell University, found a Northern Shrike (*Lanius borealis*) in a trap set for banding Juncos. The shrike, in an attempt to capture a trapped Junco, had found its own way into the trap. (Professor Fraser tells that a similar incident occurred a year or two ago.) The bird was brought to the Laboratory of Ornithology and placed in a large cage for observation.

The first thing that interested us was to know how much food the bird could consume when it was given all that it wanted. That day it was given a dead English Sparrow. Two hours later, only a few remains were found impaled on the jagged end of a stump that had been placed in the cage. The cage consisted of two compartments: an enclosed and protected portion with a window leading into an open and spacious one. The stump was in the enclosed chamber. When I introduced a dead bird the next day, I could find no trace of the sparrow of the previous day, except for a confusion of feathers. A pellet was found to contain the tarsi and the bill of the sparrow.

Until the first of March the shrike was fed one dead bird a day. These were eaten in their entirety. When the tarsi and culmen were not swallowed, they were thoroughly cleaned of meat and bone. The neatly defleshed wing bones with some primaries attached to them were often found stuck through the jagged stump.

Dr. Alden H. Miller, in his 'Systematic Revision and Natural History of American Shrikes (*Lanius*)', speaks of the "wanton killing" and "impaling instinct" of the shrikes. In an attempt to observe this trait, we placed five live English Sparrows in the cage, and for more than an hour the shrike was observed. It perched very still and paid little attention to the excited newcomers. I abandoned my post and returned an hour later. A bird had just been killed and impaled. On close observation I found no injury besides a blood clot at the base of the skull: the atlas and axis were crushed. I plucked the bird and found some marking on the skin that suggested claw marks. After putting the dead bird back into the cage, I concealed myself. The shrike caught it by the neck and flew about with it, evidently with much ease. Then it impaled the bird, and its movements were so diligently performed that one could not help doubting that this was purely instinctive behavior. After the victim had been thoroughly impaled, the shrike pulled it with powerful jerks as if to make sure that it was well anchored, then began to eat it, tearing it into large pieces by seizing it with the hooked bill and jerking backward, accompanying each movement with a swift flip of the wings to give more strength to the pull. As usual, the head was eaten

first. The remaining live sparrows had no fear of the killer, and one of them stood a short distance away, stealing bits of meat that escaped from the vigorous tearing. During the afternoon another bird was killed and partially eaten.

That same night I walked quietly to the cage and suddenly flashed a light. One of the sparrows was roosting side by side with the shrike, almost touching it. During the next two days the sparrows, one by one, met their fate. It was puzzling to notice how economical the bird was with its food. It seemed to be possessed of an almost human insight. Never did it kill a bird before all of the preceding one had been thoroughly consumed, often leaving no other trace of the victim except the major wing feathers and rectrices. The surprising thing about its food was the enormous quantity consumed: the shrike, whose weight was 53.4 grams, ate an average of one sparrow and a half per day, totaling perhaps 30 grams.

When all the birds had been eaten, a diet of dead birds was resumed. A Horned Lark (*Otocoris a. praticola*) was placed in the cage. The shrike was hungry and came for the food immediately; it clutched the lark with its feet and flew about in the outside cage. Then it perched on a drinking cup which was attached to the side of the cage, two feet from the floor, and seized the lark with its bill at the base of the skull, performing a fast biting motion of the lower mandible. Then it flew again and came back to the cup. This maneuver was repeated several times at short intervals, during which the shrike raised its head high, as if to view its surroundings and reassure itself that there were no enemies about to take away its prey. The bird looked with some interest at the cup on which it was perched, then lifted the lark and began wedging it between the cup and the wire mesh of the cage. This task was a new one and required some skill. Each movement suggested much forethought, as there was no hit or miss. When the victim slipped, it was lifted completely out of the angle and wedged back with deliberate jerks of the shrike's head and body, each jerk accompanied by a flip of the wings. From time to time, as dead birds were given to it, the shrike would repeat the mock-killing maneuvers. This seemed to be entirely instinctive, for even when the shrike was unusually hungry it behaved in this fashion.

One afternoon a live English Sparrow was put into the cage. The shrike although hungry, was indifferent and showed no apparent interest in the victim. As it was perched, I noticed an opening and closing of the mouth, as if the bird were trying to utter some notes but could not. Later, however, it seemed to be gasping. Then this became more complicated, and each time it opened its mouth there were convulsive jerks of the throat and shakes of the head. The bird was greatly fluffed and appeared ill. Its movements suggested that it was trying to vomit something, and I guessed

that it was undergoing the steps preliminary to the disgorging of a pellet. After twenty minutes of seemingly painful distortion of the throat, it threw the pellet off with a successful vigorous shake of the head. Now the bird appeared in greatly improved condition. It rubbed its bill laboriously on the perch, and began to look inquisitively at the sparrow. It made a few passes at the victim by flying toward it, and the sparrow, which had shown no fear until this time, began to fly about excitedly. The chase was kept up for half an hour without success. This was probably due to the smallness of the cage, and although the shrike was by far the more graceful flier of the two, the sparrow succeeded in getting away in swift flights which the killer could not follow. However, the pursuer was becoming more keen, and followed its prey with more vigor and enthusiasm. As the sparrow was making excited gyrations, the shrike flew at it in mid-air and seized it with its feet; then making a half circle, brought the screaming sparrow to the floor. Here, with tail outspread and wings drooped, the shrike's pose bore close resemblance to that assumed by hawks after a kill. With a last effort, the sparrow freed itself. A fervent chase ensued. Three or four times the shrike grasped the elusive prey with its claws unsuccessfully, but at last brought the sparrow down. With feet outstretched and head thrown back, it looked about in defiance; then grasped the prey at the base of the skull with its bill, biting rapidly. The sparrow's screaming ceased at once; it was dead. The shrike repeated the fast-biting motion of the bill several times, as if to make sure that the victim was dead. Then it flew about with the dead bird in its clutches, and soon began eating the head.

A day later a dead Starling was put into the cage. The shrike eyed the bird with interest, then hopped around it and made a single attempt to lift it to the cup. It succeeded in lifting the Starling only a foot into the air, and even this seems phenomenal, for the Starling weighed 89 grams—almost 36 grams more than the shrike. However, showing an understanding of the situation, it dragged the bird toward the stump, which had not been used for several days, and proceeded to impale the Starling. All of this took some effort, and the movements of the bird were not automatic like the movements associated with instinctive behavior; it seemed as though the bird were thinking about every movement that it made. The next day all that remained of the Starling were the major bones of the wings, the partly chewed sternum and the neatly cleaned leg bones. Only part of the viscera had been eaten. Dead mice and birds were introduced at divers instances into the cage, and the shrike invariably showed a preference for mice. Here again the head was eaten first as with birds.

The behavior described above has been observed from time to time, and has proved to be quite constant with this individual. The writer, however, does not claim that this observation is complete and thorough. It is pos-

sible that the behavior of this bird may have been abnormal because it was caged and in unnatural surroundings.

*Laboratory of Ornithology
Cornell University
Ithaca, New York*

SUBSPECIES OF THE SPRUCE GROUSE

BY LEONARD J. UTTAL

AFTER studying a recently amassed series of Spruce Grouse, *Canachites canadensis*, I find that I am able to recognize four subspecies of this bird. One of these, *C. c. canadensis* (Linnaeus), is made to include *C. c. osgoodi* Bishop, a name which has been applied to birds from the interior of Alaska and the Canadian Northwest. Another, a well-marked form inhabiting the Gaspé Peninsula, New Brunswick, and Nova Scotia, is herewith described for the first time. While the total number of birds examined is 129, not including several hybrids or intermediates between *C. canadensis* and *C. franklini* (Douglas), the conclusions reached in this paper are based upon the 75 adult females examined, since the males in this species are undependable for racial differentiation except in *C. c. atratus* Grinnell and the new race. The subspecies of the Spruce Grouse are based upon differences in tone of coloration. The four forms may be characterized as follows:

CANACHITES CANADENSIS CANADENSIS (Linnaeus)

Tetrao canadensis Linnaeus, Syst. Nat., ed. 10, 1: 159, 1758. Based on The Black and Spotted Heath-cock, Edwards, Nat. Hist. Birds, pl. 71, female, and pl. 118, male. Type locality: Hudson Bay.

Canachites canadensis labradorius Bangs, Proc. New England Zool. Club, 1: 47, 1899. Rigoulette, Hamilton Inlet, Labrador.

Canachites canadensis osgoodi Bishop, Auk, 17: 114, 1900. Lake Marsh, Yukon Territory.

Range.—The interior of Alaska, south to central British Columbia, west-central Alberta, and east to the Labrador Peninsula.

Subspecific characters.—Female: in winter plumage above barred with black and pale ochraceous-buff to cream buff; tips of unworn back feathers neutral gray to gray-white. Below, barred with white, black, and pale cream buff, the last predominating on the upper breast. Tarsal feathers warm gray-brown. In general appearance a predominantly gray and black bird.

Male: above olive-gray to slate-gray barred with black; scapulars and upper dorsal feathers fuscous to rich brown, the color usually stronger on the former; upper tail-coverts tinged with brown; rectrices black, their tips pale chestnut. Below, throat black, the feathers more or less tipped with white; upper breast gray; breast black; belly black, the feathers tipped with white; flanks gray barred with black, the feathers each with a terminal white wedge; under tail-coverts mainly black and white. A white line runs from eye to eye around the black throat patch. Tarsal feathers warm gray-brown.

Specimens examined.—ALASKA, Chitina River, 1 ♀, 1 ♂. YUKON, Klondike Region, 1 ♂; Teslin Lake, 2 ♀, 2 ♂. MACKENZIE, (Fort) Simpson, 1 ♀; Lobstick Creek, Little Buffalo River, 1 ♀, 1 ♂. ALBERTA, Wood Buffalo Park, 2 ♀ ad., 1 ♀ juv., 2 ♂. MANITOBA, Duck Mountain, 1 ♀; Thicket Portage, 1 ♀; Winnipeg, 1 ♀. ONTARIO, Lac Seul, 2 ♀. QUEBEC, Charleton Island, James Bay, 1 ♀;

Ungava, Fort Chimo, 1 ♀; Saguenay Co., Natashkwan, 1 ♀; Eskimo Point (Havre St. Pierre), 1 ♀, 1 ♂; Bonne Espérance, 5 ♀, 2 ♂. LABRADOR, Red Bay, 5 ♀; Hamilton Inlet, 2 ♀, 2 ♂; Lance au Loup, 2 ♀, 1 ♂; Rigoulette, 1 ♀, 1 ♂; Nain Bay, 1 ♀.

Remarks.—After examining the type series of *Canachites canadensis labradorius* Bangs, through the courtesy of Mr. James L. Peters, of the Museum of Comparative Zoölogy, I follow Norton (Proc. Portland Soc. Nat. Hist., 2: 151, 1901) and others in considering *labradorius* a synonym of *canadensis*.

Two females from Teslin Lake, Yukon Territory, fifty miles from the type locality of *C. c. osgoodi* Bishop, are inseparable from true *canadensis*. This is also true of five other females from *osgoodi* territory ranging from the Chitina River in Alaska through Yukon and Mackenzie to Wood Buffalo Park, Alberta. Most of the birds from the uncontested range of *canadensis* which I have seen are fully as pale as *osgoodi* is supposed to be. Under these circumstances I agree with Mr. P. A. Taverner, of the National Museum of Canada, who sent me these specimens, in not recognizing the validity of *osgoodi*.

Five females from Bonne Espérance, Saguenay County, Quebec, supposedly typical *canadensis* territory, are closer to *C. c. canace* (Linnaeus), of southern Canada and the northern United States, than they are to *canadensis*. Bonne Espérance, however, is far removed from the known range of *canace*. Furthermore, birds from Natashkwan and Eskimo Point, west along the north shore of the Gulf of St. Lawrence, are distinctly *canadensis* as are birds from the Red Bay district to the east. These birds do not resemble the new race from Gaspé across the Gulf. Because these birds come from but one isolated locality, naming them is no solution to the problem. Unless further collecting in this region indicates that there is a distinct area inhabited by these *canace*-like birds it is best to regard these birds as local individual variants of *canadensis*.

CANACHITES CANADENSIS ATRATUS Grinnell

Canachites canadensis atratus Grinnell, Univ. California Publ. Zool., 5: 380, 1910. Type locality: Cedar Bay, Hawkins Island, Prince William Sound, Alaska.

Range.—Coast region of southern Alaska, from Bristol Bay to Cook Inlet and Prince William Sound.

Subspecific characters.—Female: differs from *canadensis* chiefly in having the grays strongly suffused with olive. Ochraceous-buff markings lighter, more nearly a cream color. Blacks everywhere deeper in tone and more extensive in area. Below, black bars heavier, tending to run completely across each feather rather than being interrupted by the encroachment of the white portions along the rachis as in the other forms. Tarsal feathers more olivaceous.

Male: differs from *canadensis* in having the entire plumage suffused with olive.

Black instead of brown predominates in the upper tail-coverts. Blacks everywhere more strongly developed, the bars more solid and clean-cut.

Specimens examined.—ALASKA, Kenai Peninsula, 2 ♀, 3 ♂; Kelly River, 1 ♀; Homer, 9 ♀, 5 ♂; Point Graham, 2 ♀, 1 ♂; Seldovia, 3 ♀.

Remarks.—The males of this, the best-defined race of the Spruce Grouse, are quite recognizable in most cases.

CANACHITES CANADENSIS CANACE (Linnaeus)

Tetrao Canace Linnaeus, Syst. Nat., ed. 12, 1: 275, 1766. Based on *Le Gelinote de Canada*, *Bonasa canadensis*, Brisson, Orn., 1: 203. Type locality.—As here restricted, the City of Quebec, P. Q.

Range.—Southern Manitoba, southern Ontario, southern Quebec east to the west end of the Gaspé Peninsula and Maine, south to northern Minnesota, northern Wisconsin, northern Michigan, the Adirondacks of New York, and northern New England.

Subspecific characters.—Female: similar to *canadensis*, but darker throughout, the ochraceous buffs more nearly pure buff, the grays more slaty (bluer); white areas reduced; black bars somewhat more solid.

Male: indistinguishable from *canadensis*.

Specimens examined.—ONTARIO, Port Arthur, 2 ♀. QUEBEC, Kamarooska Co., Ste. Athanase, 2 ♂ ad., 1 ♂ imm.; Charlevoix Co., St. Urbain de Charlevoix, 1 ♀; Saguenay Co., Thunder River, 1 ♀, 1 ♂; Lake St. John, 1 ♀; Gaspé Co., Table Top Mt. (3,600 ft.), 1 ♀. MINNESOTA, Beltrami Co., 2 ♀; St. Louis Co., Winton, 1 ♂; Aitkin Co., Aitkin, 1 ♂. MAINE, Oxford Co., Lake Umbagog, 1 ♀; Upton, 1 ♀; Penobscot Co., La Grange, 2 ♀; So. Twin Lake, 1 ♂.

Remarks.—Following a precedent established by Oberholser (Proc. Biol. Soc. Washington, 28: 49, 52, 1914) I hereby propose to establish the city of Quebec as the type locality of *Tetrao Canace* Linnaeus *ex* Brisson. Near topotypes of *canace*, lent to me by Dr. G. A. Langelier of that city, and *canace* from Minnesota, southern Ontario, and northern New England, differ from birds from the Gaspé Peninsula, New Brunswick, and Nova Scotia, previously assigned to *canace*. The latter are consistently browner. It is evident that these birds are in need of a name and I propose that they be known as:

*Canachites canadensis torridus*¹ subsp. nov.

Holotype.—Adult female, American Museum of Natural History, no. 174919; molting about head and neck; Kejimikujik (Kedgemakoogie on label) Lake, known also as Fairy Lake, on the boundary between Annapolis and Queens Counties, Nova Scotia; September, 1921; collected by C. A. Sheldon.

Allotype.—Adult male, Louis Agassiz Fuertes Memorial Collection of Cornell University, no. 1236; fresh fall plumage; Harmony, five miles east of Truro, Colchester County, Nova Scotia; October 10, 1909; collected by Leonard C. Sanford.

Range.—The Gaspé Peninsula, New Brunswick, and Nova Scotia; possibly eastern Maine.

¹ *torridus*, "scorched"; applied to describe the extreme brownness of the females.

Subspecific characters.—Brownest of the races of *C. canadensis*.

Female: similar to *canace*, but the brown areas everywhere intensified and black areas deeper-toned; tips of unworn back feathers gray suffused with brown, tannish in general appearance rather than neutral gray as in *canace*; tarsal feathers more richly colored and more heavily barred.

Male: plumage much more suffused with brown than in *canace*, especially the upper wing-coverts, upper dorsals, scapulars, and flank feathers. Rump warmer (more brownish, less slaty) than in *canace*. General color of the upper tail-coverts strongly brown. Rectrices more solidly black, the chestnut tips darker in tone and reduced in area, especially on the central two or three pairs.

Specimens examined.—NOVA SCOTIA, Victoria Co., Baddeck, 1 ♀, 2 ♂ ad., 1 ♂ juv.; Cape North, 1 ♂ imm.; Frizzleton, 1 ♂ ad., 1 ♂ imm.; "Edge of Flat Barren," 2 ♀; Richmond Co., Framboise, 2 ♂; Halifax Co., Halifax, 1 ♀ juv., 1 ♂ juv.; Colchester Co., Truro, 1 ♀; Harmony, 1 ♂ (allotype); Annapolis-Queens Co. boundary, Kejimikujik Lake, 1 ♀ (holotype); locality indefinite, 1 ♀ (albinistic), 2 ♀, 1 ♂. NEW BRUNSWICK, Victoria Co., Trousers Lake, 1 ♀, 1 ♂; Gloucester Co., Bathurst, 1 ♀, 1 ♂; Carlton Co., Kilmarnock, 5 mi. s. of Woodstock, 1 ♀; Northumberland Co., N. Branch Renous River, 1 ♀; Gulquac River, 1 ♂; locality indefinite, 1 ♂. QUEBEC, Gaspé Co., Ste. Anne River, 1 ♀, 1 ♀ juv.; Berry Mountain Road, 2 ♀; Federal Mine, 1 ♀, 1 ♂. MAINE, Washington Co., Calais, 1 ♂; locality indefinite, 1 ♀.

Remarks.—The males of this race have constant differentiating characters which make them easily recognizable. This is especially evident when one views a series of males laid upon their sides, wing up, in which case the brown of the wing-coverts stands out strongly.

Two specimens from Maine are assignable to this race. The determination of the status of this form in that State rests upon the examination of many more individuals. Birds from western Maine are decidedly *canace*.

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To Messrs. John T. Zimmer and James P. Chapin, I am grateful for permission to work on the material in the American Museum of Natural History and for much assistance rendered while at work there.

For assistance in the location of obscure localities I am indebted to Mr. Robie W. Tufts, of Wolfville, Nova Scotia, the authorities of the Post

Office at Fredericton, New Brunswick, and the Geological Survey of Canada. Mr. W. E. Clyde Todd, of the Carnegie Museum, was a source of helpful information.

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*Laboratory of Ornithology
Cornell University
Ithaca, New York*

A NEW SWIFT FROM THE UNITED STATES

BY CHARLES H. ROGERS

THE REMARK on the label of a White-throated Swift from the collection of the late Henry K. Coale that it 'appears to be larger than Ariz. Bds.', and a preliminary examination of the pertinent material in the collection of the Princeton Museum of Zoölogy, started my borrowing, measuring, and examining skins of this species until I had studied 162 specimens. As a result, I feel justified in describing and naming as new a race which, with its type locality in Colorado, I take pleasure in naming to honor William Lutley Sclater, Director from 1906 to 1909 of the Colorado College Museum, author (1912) of 'A History of the Birds of Colorado,' and since then become famous in ways that need no mentioning.

Aëronautes saxatilis sclateri subsp. nov.

Type, P. M. Z. no. 10300, H. K. Coale, no. 21765, a male collected by Wm. Osborne (his no. 836) at Loveland, Larimer County, Colorado, 26 May 1890.

Description.—Averaging larger than *A. saxatilis saxatilis* in all measurements, especially the wing; 45 specimens of both sexes measure: wing, 142–155 mm. (average, 146.6); tail, 54–63 (average, 58.5); culmen (30 specimens), 5–6.5 (average, 5.7); tarsus (30 specimens), 10–13 (average, 11.65). Of *A. s. saxatilis*, 104 specimens measure: wing, 128–145 (one 147; average, 138.5); tail, 50–62 (average, 55.2); culmen (30 specimens), 4.5–6 (average, 5.4); tarsus (30 specimens), 9–12 (average, 10.5). All measurements are in millimeters, and the wing was straightened and flattened.

Range.—The range of *A. s. sclateri* is the northeastern part of the range of the species, in Montana, Wyoming, South Dakota, Nebraska, and most of Colorado. The range in Colorado includes the part of the State east of the Continental Divide and probably westward at least to New Castle in eastern Garfield County, whence four specimens have wings of 143, 144, 147, 147 mm., and I have included them in *sclateri*. Three specimens from western Montrose County, in the southwestern part of the State, have wings of 137, 144, 147 mm. and seem to indicate a mingling with the smaller form of nearby northwestern New Mexico, and I have not included them in the statistics of either race.

The wing and tail measurements of the Northeastern White-throated Swift, classified regionally and sexually, are as follows:

Locality	Males		
	No.	Wing	Tail
Montana.....	3	146–149 (147.–)	56–62 (58.3)
Wyo., S. D., Neb.....	7	144–149 (146.7)	56–62 (59.6)
Colorado.....	13	143–151 (146.–)	56–63 (58.8)
Average.....	23	143–151 (146.3)	56–63 (59.–)

Locality	Females		
	No.	Wing	Tail
Montana.....	10	142-153 (146.2)	55-63 (57.3)
Wyo., S. D., Neb.....	3	144-151 (147.-)	57-62 (59.-)
Colorado.....	9	142-155 (147.7)	54-61 (58.6)
Average.....	22	142-155 (146.9)	54-63 (58.-)

The White-throated Swift was originally described in 1853 by Woodhouse (Rep. Sitgreaves' Exped. Zuñi and Colo. Rivers, p. 64) as *Acanthylis sazaatilis* from birds seen at Inscription Rock, Valencia County, in northwestern New Mexico, but, as none was collected, there is no type specimen. Three skins from Gallup and Fort Wingate, within forty miles to the northwest of Inscription Rock, taken July 3-14, have wings of 139, 142, 145 mm., and two from the Jacarilla Indian Reservation, about 140 miles to the northeast of the Rock, May 26-30, have wings of 140, 144 mm., which would seem to put the type locality within the range of the smaller race.

As far as the specimens I have examined show, the range of Woodhouse's White-throated Swift is Lower California and northward at least into Oregon and eastward into Sonora and through Arizona and New Mexico to the Davis and Chisos Mountains in northwestern Texas. Wing and tail measurements from this range follow:

Locality	Males		
	No.	Wing	Tail
Oregon.....	1	136	56
California.....	11	136-144 (139.5)	52-61 (56.6)
Lower California.....	8	135-144 (139.-)	53-57 (55.5)
Arizona.....	19	128-145* (139.5)	53-61 (57.1)
New Mexico.....	10	134-145 (139.7)	51-59 (55.6)
Texas.....	1	141	55
Sonora.....	3	130-139 (134.3)	53-55 (53.7)
Average.....	53	128-145* (139.15)	51-61 (56.2)

Locality	Females		
	No.	Wing	Tail
California.....	7	132-142 (139.-)	53-61 (55.7)
Lower California.....	9	132-145 (138.1)	52-57 (54.7)
Arizona.....	20	132-144 (136.9)	52-58 (55.5)
New Mexico.....	9	136-145 (141.-)	54-62 (56.3)
Texas.....	1	134	50
Sonora.....	1	137	55
Average.....	47	132-145 (138.15)	50-62 (55.4)

* One specimen, 147.

According to these figures, females of *sclateri* average larger than males, while the reverse is true of the more western race. But in New Mexico the males of *A. s. saxatilis* average smaller than females from the same State, and that, in connection with the fact that New Mexican birds of each sex average larger than those of Arizona and the coastal States, may indicate an approach to *sclateri*, and the average of *A. s. saxatilis* as a whole would be smaller and in greater contrast with *sclateri* were the New Mexican birds not included. However, all the differences mentioned in this paragraph are very slight and may well not be significant, and, furthermore, the smallest specimen of the coastal race is labeled a male, and the smallest of the more eastern race a female, so that we may say that in this species there is very little if any sexual difference in size. Of course, in species with no difference in color either, there is always the possibility of error in sexing by the collector, but as most of the specimens studied for this paper were taken in the breeding season, this possibility is reduced to a minimum. Also due to the fact that so many of these skins were collected in May, June, and July, the tips of their remiges and rectrices were usually more or less worn, but as that condition was approximately the same in my specimens of both races, I have ignored it. For an aerial species, the amount of wear shown by the plumage is at first surprising, till one recalls the rocky, rough nature of the cavities where the birds not only nest, but roost at all seasons. Three skins collected at Zortman, Montana, during the last week of July, had the feathers of the under parts worn to shreds, but the molt had begun, recently in one, farther advanced in another, and well along toward completion in the third.

One female from Moorhead, Montana, taken June 25, 1916, has a wing of only 132 mm., not only 10 mm. shorter than any other specimen from the range of *sclateri*, but actually at the normal minimum of *saxatilis*, for I have measured only two specimens out of 104 of the latter subspecies which were any smaller. This bird is either an excessively abnormal *sclateri*, or, more probably, a straggling specimen of *saxatilis*, and I have not included it in the statistics of either race. One male from the Huachuca Mts., Arizona, taken July 18, 1894, with a wing of 147 mm., is the only specimen from the range of the smaller form measuring more than 145 and may be an early transient *sclateri*, though I have included it in *saxatilis*. I have excluded two from the Davis Mts., Texas (wings 144, 148), taken in October, two from the Chisos Mts., Texas (143, 144), taken May 13, and one from Nuevo Leon (142), taken in April, as at least possible transients. Two from the Humboldt Mts., Nevada (142, 147), may indicate that *sclateri* ranges that far west, but as I have seen no others from Nevada and none from Utah, they are inconclusive.

The normal range of individual variation in wing measurement seems to

be 13 mm. in each of these two subspecies, 132-145 in *saxatilis*, 142-155 in *sclateri*, the former normally ranging down to 10 mm. (exceptionally 14 mm.) below the minimum of the larger form, the latter up to 10 mm. above the normal maximum of the smaller.

Taking care to use only comparable material, I have painstakingly examined this series of White-throated Swifts for subspecific difference in coloration, but I have found none. This species fades noticeably both during the life of the bird and through the years after collection, and the extent of the white areas varies with the makeup of the specimen. *Aëronautes saxatilis sclateri* is, therefore, just another 'millimeter race,' which some ornithologists will not endorse, but this study has at least added to our knowledge of the geographic variation in the species, has shown the existence of two populations undeniably somewhat different, and provided a name, for the use of those who care to recognize such a difference, for the population hitherto undifferentiated.

This paper would not have been possible but for the kindness of those in charge of the collections of birds in the American Museum of Natural History, the Academy of Natural Sciences, the United States National Museum, the United States Biological Survey, the Carnegie Museum, and the Colorado Museum of Natural History, in allowing me the use of material, for which I am grateful, as I am also to Dr. H. C. Oberholser, who, as I learned in the course of my borrowing, had also begun studies toward the describing of this same swift, and who generously stepped aside in my favor.

Princeton Museum of Zoölogy
Princeton, New Jersey

GENERAL NOTES

Western Grebe in New Hampshire.—On April 3, 1938, while studying coastal birds, a group of ornithological students and I saw a Western Grebe, *Aechmophorus occidentalis*, feeding a few hundred yards offshore at Hampton Beach, New Hampshire. A Western Grebe was again seen near the same locality on May 26, 1938, by members of the same group. The swan-like neck, and the white color of head and neck, except for crown and nape which were black, clearly distinguished this grebe from the smaller Holboell's Grebe, with which the writer is acquainted.

The above record is an addition to the sight records accumulating for this bird on the New England coast, since 1934 (see Auk, July 1937).—EUGENE J. GOELLNER, Manchester, New Hampshire.

Predatory instincts in the American Egret.—Arthur H. Howell, in his 'Florida Bird Life,' page 101, states that "few data on the food habits of the American Egret are available." Neither he nor A. C. Bent in the latter's 'Life Histories,' gives any instance of predatory exhibitions on the part of this species, therefore the following incident may be an addition to the literature concerning this phase of the egret's life history. In early May 1938, while on the plantation 'Cherokee,' in Colleton Co., South Carolina, belonging to Mr. W. R. Coe of New York, the writer was told by Mr. R. F. Kirkland, the Superintendent of that property, of an observation made by the latter a few days previously. Mr. Kirkland was riding horseback over part of the plantation near one of the ricefields. He noted an egret (*Casmerodius albus egretta*) feeding along one of the ditches, and was idly watching it, when he saw the bird make a sudden dart downward with its beak. Almost immediately it rose into the air with something in the bill, and flapped away. Struck by something unusual about it, he suddenly determined to see exactly what it was, and therefore spurred his horse, attained a position almost under the bird, and by shouting and waving his arms, succeeded in making it drop the object which fell nearby. Going to it at once, he was amazed to find that it was a Red-winged Blackbird (*Agelaius phoeniceus phoeniceus*). Close examination of the bird showed it to be wounded, and since some of these birds had recently been shot because of depredations on the crops, he concluded that the specimen had been injured in that way. It was not able to fly, but could walk. The seizure by the egret had further weakened it, but it was still perfectly able to struggle. Though thoroughly familiar with Carolina Low Country wildlife, Mr. Kirkland had never before seen a like instance, and was much impressed by it. Certainly, it is utterly new to the writer, who has known the egret most of his life and has studied it throughout almost its entire range.—ALEXANDER SPRUNT, JR., R. F. D. No. 1, Charleston, South Carolina.

American Egret and Little Blue Heron in Lower Mohawk River valley.—Supplementing the reports of Stoner (Auk, 55: 119-121, 1938; Univ. of N. Y. Bull. to Schools, 24: 119-121, Mar. 15, 1938) for 1937, and of Clausen (Auk, 55: 518, 1938) for 1934, upon the status of the American Egret (*Casmerodius albus egretta*) in the lower Mohawk River valley, there are the following records for the Crescent Lake section. In only one year since 1920, or possibly earlier, has the American Egret not been seen along this section of the canalized Mohawk River; none was seen in 1934. The birds were first recorded by the writer there in 1930, when information was obtained from several independent sources showing the egrets had been regular summer visitors there at least twelve years. Only two of the birds were seen in each of the first few years, but in the late 1920's the count varied from four to eight.

Since 1930 the usual season has been from mid-July until late September. The earliest arrival date was established in 1938, with three observed on July 4; the latest departure date was in 1937, when for the first time the birds were recorded in October (through October 10, one day after duck-hunting season was opened). The counts have shown: 1930, ten, July 19 to September 20; 1931, five, early September only; 1932, one, September 1; 1933, twelve, July 9 to September 17; 1934, none; 1935, two, August 5 to 24; 1936, fourteen, July 20 to September 29; 1937, twenty-seven, July 9 to October 10; 1938, arrived July 4.

One immature Little Blue Heron (*Florida c. caerulea*) was observed by the writer at Crescent Lake on August 16, 1931; three, likewise immature, by Edgar Bedell on September 12, 1937.

Eaton ('Birds of New York,' 1908) lists no records for either species in Schenectady, Saratoga, Albany, or Rensselaer Counties.

Crescent Lake is that section of the Barge Canal (Mohawk River) extending from the Crescent dams to Lock 7, eleven miles to the west and a few miles east of Schenectady. The Crescent dams, which hold the Crescent Lake level at 184 feet, in less than two miles drop the canal to the Hudson River level of 48 feet at Cohoes. The Lock 7 dam, in turn, holds the water in the Niskayuna Lake section of the canalized river at a 211-foot level back through the Schenectady section to Lock 8, another distance of about eleven miles. In that section of Crescent Lake where the egrets are most commonly seen, the river has a maximum width of three-quarters of a mile, mostly of less than ten feet in depth, and with several small islands and large expanses of shallow, heavily grown marshes. For many years the lake has been known because of its water chestnut (*Trapa natans*), and in recent years large sections of the area have been choked, except in the canal channel and deep water, with this imported weed (intentionally introduced in Collins Lake, of the Niskayuna Lake section, in 1884). From early June until late October large areas of the river can be penetrated only with difficulty by boat, and each year has seen the weed extend its boundaries. The dense water-chestnut growth does, however, seem to attract fish, insects, and certain birds. Crescent Lake has a very irregular shore, with many bays and coves, mostly as marshes. It borders the abandoned, water-filled Erie Canal on the Saratoga County side, and has numerous small ponds adjoining it. For many years there has been a large colony of Black-crowned Night Herons on the Saratoga side, and it is in this heronry that most of the egrets seem to collect at night. Great Blue Herons are not known to breed in the immediate vicinity, but they are common summer visitors along the section. Green Herons, and American and Least Bitterns are local breeders, with the first mentioned relatively common.—GUY BARTLETT, *R. D. 1, Schenectady, New York.*

African Cattle Heron taken in British Guiana.—An Old World genus, not previously recorded in the western hemisphere, was added to the American fauna as an accidental visitant with the collecting of an African Cattle Heron, *Bubulcus i. ibis*, near Buxton, East Coast, British Guiana, by the writer on May 27, 1937. This specimen (F. M. no. 108,002) is an apparently adult female in modified nuptial plumage. The dorsal plumes are entirely lacking but the crest feathers and sparse pectoral plumes are typically sienna, although only vaguely tinged with vinous. The legs are yellowish, becoming dusky brownish on the feet. Measurements: wing, 244 mm.; tail, 93; culmen, 56. The bird was found feeding in company with scores of Snowy Egrets, Tricolored and Little Blue Herons in a partially submerged ricefield near the railway, about a mile east of Buxton, a native village on the coastal plain approximately eleven miles east of Georgetown. So far as could be observed,

the Cattle Heron was in no way directly associated with the native herons or antagonistic to them. An effort has been made to trace the origin of this individual, but without success. Officials and others questioned in British Guiana assure me that it could not have entered the Colony as a cagebird. One can only speculate upon the combination of natural factors which could have made possible the transatlantic passage of this African species.—EMMET R. BLAKE, *Field Museum of Natural History, Chicago, Illinois*.

White-fronted Goose at Madison, Wisconsin.—On March 27, 1938, twenty of these geese (*Anser albifrons albifrons*) were found by Arthur Hawkins and the writer two miles south of Madison, standing on the edge of a small pond. About a third of them had the white frontlet well developed, while on the others it was inconspicuous, indicative of young birds. They did not fly until all had waded out and started to swim. When they took off they started first northeasterly, but after going some distance they turned and circled back over our heads, then headed toward the northwest, in which direction they held to a straight course until they disappeared from view. It seemed to us that they had returned in order to get their bearings. This is the first record for Dane County.—JOHN S. MAIN, *Madison, Wisconsin*.

European Widgeon at Louisville, Kentucky.—Due to sharp rises in the Ohio River, a rather large area of cornfields became flooded near Harrod's Creek, Jefferson County, Kentucky, about six miles east of the city of Louisville. This area was very attractive to migrating waterfowl and large numbers of them gathered here throughout the month of February. On February 22, 1939, three European Widgeon (*Mareca penelope*) were noted in company with American Pintail, Baldpate and Ring-necked Ducks. They were watched at a distance of about 100 yards with a 24-power binocular and a 30-power telescope in good light for about an hour. There were two males and what was apparently a female. The latter bird could not be positively identified. However, the two males, with their reddish heads and reddish-buff stripes, were unmistakable. These markings, together with the fact that they were with Baldpate which furnished a perfect comparison, made their identification unquestionable. One male bird was seen again on the successive days of February 25, 26, 27, and 28. With the assistance of Jacob P. Doughty, of Louisville, I was able to collect it on February 28. This marks the first record for the State of Kentucky as far as I can ascertain.—BURT L. MONROE, *Kentucky Ornithological Society, Louisville, Kentucky*.

Pintail nesting in New Brunswick.—On May 20, 1938, I observed six mated pairs of Pintails (*Dafla acuta tsitzihoa*) feeding in a small marsh area near Midgie, Westmorland County, New Brunswick. When I revisited the same locality on May 28, a careful search disclosed seven males and only two females, leading me to believe the others might be nesting nearby. I enlisted the aid of John Tingley, game warden, who found a pair on June 2, and finally on June 6, 1938, he flushed a pair of Pintails, the female from a nest of ten eggs, in the same locality. So far as I know, this is the first Pintail nest found in the Province of New Brunswick. Probably other pairs of Pintails nested in the same area, a part of the vast Tantramar marshes covering about 200 square miles on the border of New Brunswick and Nova Scotia.—HAROLD S. PETERS, *U. S. Biological Survey, Charleston, South Carolina*.

Bahama Pintail in Virginia.—On December 17, 1937, Mr. Starling W. Childs shot a Bahama Pintail (*Dafla bahamensis*) on the property of the Horn Point Gun Club, Peter's Cove, Pungo, Virginia. The bird, which accompanied a flock of forty

or fifty American Pintail, is an adult of undetermined sex. It has been mounted and presented to the American Museum of Natural History.

The association of this duck with the American Pintail (*Dafila acuta*) is interesting because examples of the latter species are known to winter in the Bahamas and West Indies, and also because of the apparent predilection that *bahamensis* has for closely related ducks. In southern South America, for example, the Bahama Pintail commonly associates with the Brown Pintail (*Dafila spinicauda*) and the American Museum possesses a hybrid between these two species.

The fourth edition of the A. O. U. 'Check-List' (1931) records only two earlier occurrences of the Bahama Pintail in continental North America, namely, one on the east coast of Florida and one in Wisconsin.—ROBERT CUSHMAN MURPHY, *American Museum of Natural History, New York City*.

Blue-winged Teal in unusual numbers at Fort Erie, Ontario.—For the past year or more it has not been unusual, during the late spring and again in the latter part of summer, to see small parties of Blue-winged Teal (*Querquedula discors*), up to six or eight in number, feeding among the shallow reedy waters of certain parts of the Niagara River near Fort Erie. Such seasonal occurrences of small numbers are not particularly surprising for the species is known to breed sparingly in relatively nearby territory in New York State, but the occurrence of a flock of from 75 to 80 in the river at Fort Erie on August 22, 1938, and the finding of what must have been that same flock swollen to an aggregate of not less than 125, in the above-mentioned reedy shallows, a few days later, on August 27, would appear to be worthy of record.—R. W. SHEPPARD, 1805 Moulton Avenue, Niagara Falls, Ontario.

American Scoter at Harrisburg, Pennsylvania.—During a flight of several thousand ducks on the Susquehanna River, April 19, 1939, three White-winged Scoters (*Melanitta deglandi*) were seen. The ducks were mainly Scaup and Oldsquaws, with numerous Buffleheads and some Golden-eyes; Black Ducks and Mallards had preceded them by a week or two. The White-winged Scoters have occasionally been found here, as three times during May 1935. The following day, April 20, 1939, I found a female American Scoter (*Oidemia americana*) on Wildwood Lake within the city limits and a mile from the river. This American Scoter was easily identified at a distance of 150 feet with a binocular, and constitutes a first record for this locality, as far as I have learned. There is nothing to account for its presence here, except the excessive flight of ducks.—HAROLD B. WOOD, *Harrisburg, Pennsylvania*.

Feeding habits of Black Vulture.—On October 31, 1936, when banding Black Vultures (*Coragyps atratus atratus*) in a large, open hayfield on the east side of Avery Island, Louisiana, I noticed a three-quarters-grown skunk (*Mephitis mesomelas*) going leisurely across the field. The grass was short, having recently been cut. The trap contained that morning something over one hundred vultures, some of which had been in it twenty-four hours. One of the yearling vultures, after having been banded and liberated, alighted near the skunk which was then about two hundred feet from where I stood at my banding work. The skunk immediately stopped and raised its tail. Other vultures that were sitting around on the ground soon joined the one that was near the skunk, and when six or eight of them had gathered about the animal, one suddenly attacked it from the side. The skunk immediately discharged its musk, but this seemed to have no effect on the vultures, which, on its discharge, attacked in a mass. As soon as the attack was made, other vultures that were circling above the meadow or sitting in the trees nearby, joined the group, until

there were probably twenty-five or more around the skunk. They piled on to it, and with much flapping and croaking, pulled it about until it was dead, then devoured it.

As this was a most unusual occurrence, I made note of it, and thought no more of it until October 1, 1938, when I saw exactly the same thing happen, except that I did not see the beginning of the attack, but did see a number of vultures pulling something about in a freshly cut hayfield and upon driving near them, found they were attacking a full-grown skunk. On my walking near, the vultures hopped away a short distance from their victim. An examination of the skunk showed it to be still alive, but with most of the hair torn from it, both eyes pecked out, and a number of fresh wounds through its skin. As soon as I got back into my car, the vultures again piled on their victim and in a few minutes as I watched, they tore it to pieces and devoured it.

The boy who was with me, son of my game warden who takes care of the east side of the Island, told me that within the past few weeks he had seen a number of such attacks by Black Vultures upon live skunks. The vultures always killed and ate the skunk. I had made note of the scarcity of skunks about the place during the past three or four weeks. Previous to that time, that is, during July, August, and early September, skunks had been extremely abundant, and on some cloudy afternoons as many as one hundred or more could be seen in a drive of but a couple of miles about the place. As it is my desire to allow Nature to balance itself on the Island, skunks are not disturbed and therefore, are fearless and can be seen almost any time of the day in the meadows searching for insects. It was not uncommon during August and September to see as many as five, eight, or more skunks at one time in the grassy meadows and on the open hillsides. For the past couple of weeks, however, I had not seen a skunk. After my experience on October 1, I spoke of the occurrence to my game warden, Alva Perrera, who looks after the east side of the place, and asked him why he thought skunks were so scarce. His reply was: "The buzzards have killed them all." By 'buzzards' he meant Black Vultures. On questioning him, he said that on many occasions during the past two or three weeks, he had seen 'buzzards' alight near a skunk in an open field, attack it and destroy it.

In the afternoon, especially on cloudy days, skunks go into the open meadows in search of insects. A vulture, seeing a skunk thus engaged, will alight near it and walk along with it as it moves about. Other vultures will quickly join the one following the skunk, and as soon as eight or ten have assembled, one will attack the skunk from the side. The skunk usually discharges its musk as soon as attacked, and this seems to be the signal for a general attack by the assembled vultures, and they will quickly kill and eat it. At times as many as fifty or more will be gathered around one skunk, each bird trying to get hold of a morsel of the flesh. Alva said he has seen 'buzzards' kill skunks in this way for several years, but only in the months of September and October. The probable reason for the vultures' attacking the skunks at this time of the year is that these months are usually dry, and when there is a protracted dry spell, there is little or no mortality among the livestock on the ranges of Avery Island, therefore, no food for the vultures.

On October 12, 1938, about 4.30 p. m., I saw a Black Vulture come from high in the air and alight near two full-grown opossums that were following a narrow cattle trail which led from the cypress swamp at the foot of the hills across a wide piece of open land to the timber on the hills. The first vulture was almost at once joined by many others that dropped down from the sky with almost unbelievable swiftness, until there were probably between seventy-five and one hundred Black Vultures

following the opossums,—some on both sides, some in the rear. Suddenly, three or four of the vultures attacked one opossum at the same time. In less time than I can write it, both opossums were covered with a swarm of hissing, flapping birds, and within fifteen minutes there was nothing left of them but the larger bones and the hides, and these were stripped of every vestige of flesh.

It is also of interest to note in the feeding habits of these birds, that during dry periods when food is scarce, Black Vultures congregate in the early morning where the herds of cattle are bedded down for the night, and as the cattle move off to graze shortly after sun-up, the vultures feed on the fresh excrement which the cattle drop as they begin their day's grazing. This is a common feeding habit of the Black Vultures which I have observed for many years. The Turkey Vulture (*Cathartes aura septentrionalis*) apparently has not this same food habit, nor have I ever seen it attack a living animal.—E. A. McILHENNY, Avery Island, Louisiana.

Eastern Sparrow Hawk feeding on big brown bat.—About 6.30 o'clock (eastern daylight time), on the morning of May 5, 1939, while observing birds in Washington Park in the heart of the city of Albany, New York, my attention was drawn to a female Eastern Sparrow Hawk (*Falco s. sparverius*) perched high up in a large elm. As I watched, the bird, evidently unaware of my presence, suddenly darted from its vantage point to the trunk of an adjacent tree of similar kind and size, seized and carried away what appeared through the binocular to be a small bat. The color of the victim, its shape and a brief view of the tip of a weakly flapping wing afforded the bits of evidence for my first and provisional diagnosis.

On following the flight of the hawk it was observed to alight well out on the limb of another elm, about fifty feet above the ground, where at once it began vehemently and greedily to devour the prey. The first struggles of the victim, manifest principally in the flapping of one wing, soon subsided as the hawk continued to tear it to pieces. Perhaps two minutes elapsed before the bird had finished the meal. As I continued to watch these proceedings through the binocular, I wished that some way might be found to determine definitely on just what the hawk was feeding. Then, as though in answer to this thought, it arose in flight and in so doing dropped from its claws a fragment of the prey. Upon examination this proved to be the facial portion of the head of a big brown bat, *Eptesicus fuscus*. Although the brain case had been removed by the hawk, the furred facial skin, the intact left ear and the complete dentition provided sufficient evidence for positive identification of the bat. All the other parts of the animal had apparently been eaten by the hawk.

I have never before observed this feeding habit of the Eastern Sparrow Hawk and so far as I have been able to ascertain, records of the occurrence of this or any other bat in the stomachs of Sparrow Hawks appear to be very rare.—DAYTON STONER, New York State Museum, Albany, New York.

Falcon, Buteo and Harrier eat Herring Gull.—That many if not all of our hawks are occasional carrion eaters is a long-established fact and yet all too seldom is this factor mentioned or at least given sufficient significance when an analysis of the stomach contents of one of these birds is published. The writer has had several occasions to see how erroneous it might be for a stomach-contents analysis to be taken as a sign of exactly what the raptors might be killing. A recent observation even though extreme, strongly illustrates this point. While driving along an extensive mudflat on the south shore of Long Island my attention was attracted to a bird ripping apart a dead Herring Gull (*Larus argentatus smithsonianus*). The bird turned out to be a large adult Duck Hawk (*Falco peregrinus anatum*) which circled

widely, boisterously resenting my approach to its food. Even though the gull was still rather warm indicating recent death I hesitate to conclude that it had been actually killed by the Peregrine, for I have never seen any species of hawk even threaten an adult gull.

The same afternoon while returning past this spot I was astonished to see an American Rough-legged Hawk (*Buteo lagopus sancti-johannis*) standing on the dead gull tearing off scraps of meat. I sat in my car for fully ten minutes watching this operation and then proceeded home. But the climax was not reached until the following day when I found a Marsh Hawk (*Circus hudsonius*) gleaning what it could from the nearly devoured carcass. Here were three species of hawks eating from the same piece of carrion. Anyone capable of analyzing the stomach contents of these birds assuredly would hesitate to say that the two latter species, if not the Peregrine, had destroyed this powerful gull. But then, the piece of carrion could just as well have been a dead pheasant or a dead chicken and the three hawks subsequently win the damnation of any sportsman witnessing the feast or reading of an authentic stomach-contents analysis by some scientist.—ALLAN D. CRICKSHANK, *National Association of Audubon Societies, New York City.*

Purple Gallinule in Maryland.—On October 12, 1938, R. B. Smithers shot a gallinule on the Patuxent Marsh in lower Anne Arundel County, Maryland. The bird was sent in the flesh to the Natural History Society of Maryland. The specimen proved to be an immature female, and although we were not very familiar with gallinules in this plumage, characters of tarsi and nostrils indicated that it was a Purple Gallinule (*Tringoides martinica*). In January 1939, we were able to have this identification verified by Dr. Herbert Friedmann of the United States National Museum. The coloration tallies very closely with the description given for the juvenal plumage by Bent (Bull. U. S. Nat. Mus., no. 135, p. 342). There is no indication of the dark purplish feathers which appear on the under parts in the post-juvenal molt. Thus, according to Bent's statements, the bird was probably less than two months old.

Although there are numerous records of the casual occurrence of this species north of the breeding range, it appears that no specimen has ever before been taken in Maryland. Kirkwood, in his list of Maryland birds (in Trans. Md. Acad. Sci., 1895, p. 281) speaks of one reported by Richmond to have been seen in Centre Market in Washington, D. C., from "down the Potomac somewhere." However, Cooke makes no mention of this species in her careful review of the 'Birds of the Washington, D. C., region' (Proc. Biol. Soc. Washington, 42: 1-80). Bent (op. cit., p. 345), in a long list of casual occurrences, has no record from Maryland. Hence, it appears that this species can be added to the still inadequately inventoried avifauna of Maryland.—I. HAMPE, H. SEIBERT, H. KOLB, *The Natural History Society of Maryland, Baltimore, Maryland.*

Spring flight of Golden Plover at Madison, Wisconsin.—On June 7, 1939, Mr. John Main and I found a flock of about forty Golden Plover (*Pluvialis d. dominica*) feeding in a field on an area known formerly as the 'Stoner Prairie.' A group of six birds that had separated from the main flock allowed me to approach within a distance of 75 feet. The large flock remained through the 14th; on the 15th, only six birds were left. Previously, neither of us had seen a flock in spring during the past twenty years.—A. W. SCHORGER, 168 N. Prospect Avenue, Madison, Wisconsin.

Recent observations on the Eskimo Curlew in Argentina.—In view of the near extinction of the Eskimo Curlew (*Phaeopus borealis*) it is of interest to record

some observations detailed in a recent letter to me from Mr. Ernest Ronald Runnacles, of General Lavalle, in the eastern part of the Province of Buenos Aires, Argentina. The region is one which has long been well known to ornithologists from the early investigations of Mr. Ernest Gibson, so that modern studies here have a double importance.

Mr. Runnacles, who is thoroughly familiar with the birds of his region, writes me that on February 16, 1937, he saw two, or possibly three, Eskimo Curlews on a level plain near the town. The birds were quite wild and were observed for some time from an automobile. One had been seen in this same region about a month previous, and another was recorded there on February 19. On the 28th of the month the birds had disappeared. Finally, one individual was seen at this same place on January 17, 1939.—ALEXANDER WETMORE, *U. S. National Museum, Washington, D. C.*

Western Sandpiper near Chicago.—A number of reports of the presence of the Western Sandpiper (*Ereunetes maurii*) in the Chicago region, based on sight records, have been published during recent years. We have very few records based on specimens, however, and it seems advisable to report one which I collected several years ago. This specimen, a male, was taken at Waukegan, Lake County, Illinois, on July 29, 1928. It was identified by Dr. H. C. Oberholser and bears the number 516 in my collection.—STEPHEN S. GREGORY, JR., *Winnetka, Illinois.*

Black Terns in New Brunswick.—While studying the nesting of waterfowl on June 14, 1937, near Sheffield, Sunbury County, New Brunswick, I saw six Black Terns (*Chlidonias nigra surinamensis*) flying over a marshy area along a small creek. When near the same place on May 26, 1938, I observed three Black Terns which indicated, by their actions, that they might be nesting nearby. Lack of time prevented a search for a nest, but the marshy area was well adapted to their use. Again, on May 24, 1939, four Black Terns were observed flying over the same small marshy area. I know of no record of this species having nested in New Brunswick. Col. H. H. Ritchie, chief game warden of New Brunswick, and John Campbell, game warden, were with me when the terns were seen in both 1937 and 1938.—HAROLD S. PETERS, *U. S. Biological Survey, Charleston, South Carolina.*

Spring record of Dovekie in the Connecticut valley.—The strong blow on May 13, 1938, brought bad luck to a female Dovekie (*Alle alle*) a hundred miles or more inland from its native element. In the town of Granby, Massachusetts, Mrs. Henry Boyer reported sighting what she thought to be a chicken by the roadside as she rode with her husband westward toward Holyoke. Mr. Boyer stopped the car to investigate. The strange bird fluttered off down the road at his approach. After a chase of twenty-five feet or so, he succeeded in dropping his hat over the bird, which seemed to him exhausted rather than injured. He left his captive at a nearby farm where the bird expired two days later. At the Holyoke Museum of Natural History the specimen subsequently proved to be a female.

All previous records of the Dovekie in this section of the Connecticut Valley have occurred during the late fall or early winter. This is the first capture to be recorded in the spring of the year.—AARON C. BAGG, 72 *Fairfield Ave., Holyoke, Massachusetts.*

Left-handedness in the Carolina Paroquet.—In connection with Friedmann and Davis's paper on "Left-handedness" in Parrots' in the 'Auk' for July, 1938, it may be worth while to call attention to Wilson's account of that behavior as it existed in *Conuropsis carolinensis*. (Though the individual particularly observed was taken alive at Big Bone Lick, Kentucky, and therefore may be presumed to have

belonged to the subspecies *ludovicianus*, the habit was doubtless specific rather than subspecific.) Wilson ('American Ornithology', London, 1: 384, 1832) says of his captive bird that in eating the seeds of the cockle-bur "it always employed its left foot to hold the bur, as did several others that I kept for some time," and he goes on, "I began to think that this might be peculiar to the whole tribe, and that the whole were, if I may use the expression, left-footed; but by shooting a number afterwards while engaged in eating mulberries, I found sometimes the left, sometimes the right, foot stained with the fruit; the other always clean; from which, and the constant practice of those I kept, it appears, that, like the human species in the use of their hands, they do not prefer one or the other indiscriminately, but are either left or right footed." It would be interesting to note whether hawks or owls or any other birds that grasp their food use one foot more than the other.—FRANCIS H. ALLEN, West Roxbury, Massachusetts.

Western Olive-backed Thrush in West Virginia and Tennessee.—The western form of the Olive-backed Thrush, described by Oberholser as *Hylocichla ustulata almae* is not recognized in the last edition of the A. O. U. 'Check-list,' but recent discussion by van Rossem (Field Mus. Nat. Hist., 23: 457, 1938) and by Oberholser (Louisiana Dept. Cons., Bull. 28: 472, 1938) indicates that it is distinct. Examination of specimens substantiates the claim that it is to be differentiated by grayer, less-brownish dorsal coloration, a character that separates it clearly from the eastern race.

As *Hylocichla ustulata almae* ranges eastward in migration, I have reexamined specimens secured recently in West Virginia and Tennessee for the U. S. National Museum, with the result that several prove to be of the western form. One of these is a male taken on Pine Creek, near Enon, West Virginia, May 8, 1936. The following come from Tennessee: male, nine miles north of Waynesboro, Wayne County, May 11, 1937; male and female, near Reelfoot Lake, Obion County, April 27 and 28, 1937; and two males, four miles west of Hornbeak, Obion County, May 1, 1937. Other specimens listed in the two reports on collections from the two States in question are *Hylocichla ustulata swainsoni* as previously indicated.—ALEXANDER WETMORE, U. S. National Museum, Washington, D. C.

Starlings nesting near Rogers, Arkansas.—A pair of Starlings (*Sturnus vulgaris*) appeared at a bluebird box on May 2, 1938. After some chasing by Mockingbirds, Flickers, and Red-headed Woodpeckers the Starlings settled in a woodpecker's nest hole, working on the nest till May 8 when the first egg was deposited. May 13 the complement was complete, six eggs. On May 19, ten Starlings settled in the nest tree. On May 26, three young were in the nest; they left the nest June 14. On May 30 a flock of young Starlings was seen in an oat field, apparently an earlier hatching not far away. A second brood was begun in the same nest tree, June 20, but removal of four eggs apparently prevented rearing of this brood. A second nest observed in Rogers was in an old woodpecker's nest in a tree. Four young Starlings left the nest (June 27) when boys attempted to investigate. A third Starling nest was found in a telephone post, west of Rogers.—F. D. CROOKS, Rogers, Arkansas.

Starlings in New Mexico.—Suspecting the presence of Starlings (*Sturnus vulgaris*) in eastern New Mexico because of their occurrence nearby in the Texas Panhandle, I had my suspicion confirmed on March 7, 1939. At Texico, Curry County, on that date I observed a flock of seven, and a few hours later at Clovis saw several more. On March 8, several hundred were observed in the vicinity of Clovis. Several residents in the vicinity of Clovis mentioned to me that the birds were new

and unfamiliar. The Starlings were very wild and despite my efforts to collect one I was unsuccessful. However, the birds were often seen close by and observed with a 7 x 35 binocular.

Many years of familiarity with the Starling in the East leave no doubt in my mind as to the identity of the birds. To the best of my knowledge this bird has not been reported previously from New Mexico. It is also worthy of record in the history of the westward progress of the Starling.—PHILIP F. ALLAN, *U. S. Department of Agriculture, Amarillo, Texas.*

Seasonal Starling numbers in suburban Long Island.—The Starling (*Sturnus vulgaris*) has long been well established in suburban Long Island, and there seems to have been no material change in its abundance there for many years. To obtain an index of its numbers for comparison with other localities, and learn something of the seasonal fluctuation, I made approximate counts of Starlings noticed from the trains in commuting between Garden City (occasionally Mineola, an adjacent village also about twenty miles from town) and New York, from September 8, 1936, to September 8, 1938. The first year comprised 57 such counts for 100 miles or more of observation each (100 to 143 miles), the second year 61 similar counts. The first year the counts averaged 1.6 to 5.9 birds per mile. The total for the year was 19,998 Starlings and 6,286 miles, or 3.2 per mile. The second year they averaged 1.4 to 7.1 birds per mile. The total was 18,620 Starlings for 6,762 miles, or 2.75 per mile. The seasonal fluctuations did not correspond for the two years but followed a similar pattern. The numbers were found to be lowest in the Starling's breeding season, April 20 to May 30, 1937 (varying from 1.6 to 2.3), April 21 to June 14, 1938 (varying from 1.4 to 2.35). Coincident with the appearance of young birds on the wing there was an appreciable rise in numbers in June of both years. The highest counts, attributed as an hypothesis to invasion of the area by young from outside, came between July 26 and August 15, 1937 (average 5.0), and August 11 and September 8, 1938 (average 4.1). The regular fall migration peak of adults, which from other data are thought to leave the breeding area by October normally (Bird-banding, 8: 76, 1937), is presumably reflected in a later abundance, from September 29 to October 24, 1936 (average 4.55), and from September 20 to October 20, 1937 (average 4.1). After this, numbers fall off, and there was a winter minimum from November 12 to December 31, 1936, with averages fluctuating between 1.8 and 3.1, from November 11, 1937, to January 7, 1938, between 1.3 and 2.3. Later figures seem to corroborate data from banded birds observed which indicate that the vernal return of residents is already under way in January (Bird-banding, 1937, l. c.). In 1937, numbers rose sharply for January, remained constant for February and rose again for March and April. In 1938, a slight rise for January was continued in early February, after which numbers were appreciably lower.

For the two years, September 8, 1936, to September 8, 1938, counts total 38,618 Starlings for 13,048 miles, 2.95 per mile. Combining all the averages, each for upwards of 100 miles, by averaging all those in whole or in part within each of six five-day periods of every month, gives a curve of seasonal variation in numbers (the main features of which would presumably remain unchanged if based on several years' data) as follows.

September 16-20, 3.1 per mile; 21-25, 3.6; 26-30, 3.9; October 1-5, 4.5; 6-10, 4.1; 11-15, 4.2; 16-20, 4.35; 21-25, 4.1; 26-31, 3.1; November 1-5, 3.3; 6-10, 3.5.

November 11-15, 2.5 per mile; 16-20, 2.1; 21-25, 2.2; 26-30, 2.5; December 1-5, 2.2; 6-10, 2.3; 11-15, 2.05; 16-20, 2.1; 21-25, 2.3; 26-31, 2.25; January 1-5, 2.8; 6-10, 2.8; 11-15, 2.8; 16-20, 2.75; 21-25, 2.85.

January 26-31, 3.0 per mile; February 1-5, 3.15; 6-10, 3.3; 11-15, 3.2; 16-20, 3.0; 21-25, 3.15; 26-28, 2.9; March 1-5, 3.1; 6-10, 2.75; 11-15, 2.4; 16-20, 2.7; 21-25, 3.4; 26-31, 3.2; April 1-5, 2.6; 6-10, 3.2; 11-15, 3.3.

April 16-20, 2.7 per mile; 21-25, 1.9; 26-30, 2.1; May 1-5, 1.9; 5-10, 1.8; 11-15, 1.8; 16-20, 1.75; 21-25, 1.7; 26-31, 1.7; June 1-5, 2.2; 6-10, 2.2; 11-15, 2.8.

June 16-20, 3.15 per mile; 21-25, 3.0; 26-30, 2.4; July 1-5, 2.1; 6-10, 2.35; 11-15, 3.15; 16-20, 3.1; 21-25, 2.6.

July 26-31, 4.1 per mile; August 1-5, 4.1; 6-10, 4.25; 11-15, 4.9; 16-20, 3.25; 21-25, 3.65; 26-31, 3.3; September 1-5, 5.0; 6-10, 3.7; 11-15, 3.05.

Some winter Starling counts made on a 7.5 mile bus ride, January 20 to March 9, 1937, in suburban New Jersey between Elizabeth and Tremley Point, and furnished me by Robert W. Storer are interesting in comparison. They total an estimated 3297 Starlings for some 247.5 miles,—or 13.3 per mile. This much higher figure confirms the great concentration of wintering Starlings in New Jersey as compared with Long Island (Auk, 54: 210, 1937). Arbitrarily dividing these counts into four periods by dates we have 19.7 per mile for January 20 to 29; 13.2 for February 1 to 11; 11.7 for February 15 to 26; 8.2 for March 1 to 9. This decrease presumably represents the early ebbing of birds from a point of winter concentration and is presumably correlated with their increase and the return of resident individuals on Long Island.—J. T. NICHOLS, New York City.

Dysmorodrepanis munroi probably not a valid form.—A careful examination of the type of *Dysmorodrepanis munroi* Perkins (Ann. Mag. Nat. Hist., (9) 3: 150, 1919), shows it to be, in all probability, an aberrant young female of *Psittacirostra psittacea*. It was taken in the Kaiholena Valley, Lanai, Hawaiian Islands, by G. C. Munro in 1919. It is no. 4792 in the B. P. Bishop Museum, Honolulu. In spite of diligent search he has never been able to find another specimen.

At first glance this bird with its generally pale-yellowish coloration, its yellowish-green lores and ill-defined yellowish-green supraocular stripe and even in the deformation of the bill is reminiscent of *Pseudonestor*. Closer examination, however, shows clearly that its affinities are with *Psittacirostra*. The bill with its ridged culmen (this character is more strongly marked in young birds), wide at the base, and the nostril which is a slit in the rounded and depressed operculum, prove this, for in *Pseudonestor* the nostril is rounded, is not set in an operculum, and, even in young birds is covered with small feathers from which vibrissae project. Furthermore, the outer webs of primaries 2, 3, 4, 5 are attenuated for one-third of their length in *Psittacirostra* and '*Dysmorodrepanis*' but are normal in *Pseudonestor*. In size the former are larger than the latter. The lower mandible is the most striking feature of this supposed form for the cutting edge is turned in and touches the upper only at the tip. In this respect it is unique. Not only is the bill of this specimen aberrant but the plumage is also partially albinistic. The outer webs of the primaries are edged with white as are the inner webs of the secondaries. The primary coverts are also tipped with white and the secondary coverts are broadly margined and tipped with white, leaving only a small dark central area. Whitish feathers are scattered indiscriminately over nape, breast and belly.

Other specimens of *Psittacirostra* from Lanai show the same tendency toward albinism in their whitish wing-coverts, but none has the yellowish tinge on lores and supraocular region, nor do they show any deformation of bill approaching the condition in '*Dysmorodrepanis*,' though bills do vary. S. B. Wilson in '*Aves Hawaiienses*' (p. 87) cites this with a cut to illustrate it. This may well mean that in the genus there is a tendency toward mutation, which, exaggerated by the smallness of the population on the island, is expressed in the extraordinarily deformed bill.

There is in this genus a wide range of individual variation of color tone as well. A series of two males and one female from Lanai and Molokai in the British Museum are considerably paler than specimens from Hawaii, but more material in the Rothschild collection and the Bishop Museum, Honolulu, proves that the difference cannot be correlated with geography. This wide variation made Stejneger (1887) wonder whether there could be two species on Kauai Island and it was also noted by Wilson (t. c., p. 87) in specimens from Molokai.



TEXT-FIG. 1.—At the left, head of *Psittacirostra*; at the right, head of '*Dysmorodrepanis*'. Natural size.

Although, of course, the deformation of the bill of this curious specimen may be due to an accident, it would appear even more probable that it is a 'sport' in view of the fact that the population was very small even in 1919. Now it is even smaller, or, even more probably, exists no longer on the island. In an airplane flight over the mountain last autumn I could see only a very small grove of trees at the very top. The arable land is planted in pineapples. With its habitat thus reduced and in view of the fact that its congeners are very rare indeed on all the islands of the group, we may well suppose that *Psittacirostra* has disappeared from Lanai. In spite of diligent search Munro, who was Perkins's assistant, has never been able to find another specimen of '*Dysmorodrepanis*'. He reported to Perkins (t. c., p. 252) that on August 12, 1918 (a year before he obtained the type), he saw a bird with light coloring around the eye and a short tail, and though he could not distinguish the form of the bill, he felt sure it was "the other."

Measurements of a long series of females of *Psittacirostra psittacea* are as follows: wing, 86–91 mm.; tail, 51–53; bill, 11–15. The type of '*Dysmorodrepanis*' measures as follows: wing, 86 mm.; tail, 51; bill, 14.—JAMES C. GREENWAY, JR., *Museum of Comparative Zoology, Cambridge, Massachusetts*.

Kirtland's Warbler at Kalamazoo, Michigan.—The Fitz Henry Chapin collection of birds was recently given to the University of Michigan Museum of Zoology by Mrs. Paul H. Todd of Kalamazoo. Among these specimens I found the fifth Michigan specimen of Kirtland's Warbler (*Dendroica kirtlandi*). This bird, a female, was taken May 15, 1886, at Kalamazoo by Mr. Chapin. He never published the record and Frank M. Chapman did not know of its existence when, in 1898, he summarized what was known of this species (Auk, 15: 289–293, 1898; *ibid.*, 16: 81, 1899). In 1898, Morris Gibbs (Bull. Mich. Ornith. Club, 2: 7, 1898) mentioned that Chapin had taken such a specimen, thus adding it to the list of birds known to occur in the Kalamazoo region, but Gibbs did not mention the sex of the bird or the date of collecting. Nevertheless, in 1904, Norman A. Wood (Bull. Mich. Ornith. Club, 5: 12, 1904) quoted this record as of 1898 and thereafter W. B. Barrows (Michigan Bird Life, 1912: 621) and others quoted Wood and perpetuated the error. C. C. Adams (Bull. Mich. Ornith. Club, 5: 18, 1904) gave May 15, 1885, for this record and quoted a letter he had from Chapin concerning details. However, Chapin's original cata-

logue entry, apparently made at the time of collecting, is May 15, 1886. The fact that this specimen was collected in 1886 rather than 1885 is further confirmed by a mention of the bird in the May 15, 1886, entry in Mr. Chapin's diary.—JOSSELYN VAN TYNE, *University of Michigan Museum of Zoology, Ann Arbor, Michigan.*

Mourning Warbler nesting in the Chicago region.—With the appearance of Mr. O. J. Gromme's note on the 'Mourning Warbler nesting in Wisconsin' in the July, 1938, issue of 'The Auk,' the writer was prompted to submit a brief mention of a breeding record of the Mourning Warbler (*Oporornis philadelphia*) for the Chicago region, reported in detail in the 'Program of Activities of the Chicago Academy of Sciences' (6: 85-87, 1935). A pair of Mourning Warblers, discovered near LaGrange Park, Cook County, Illinois, were observed attending a Cowbird out of the nest on June 14, 1935. The male, in full song and often carrying food, was observed repeatedly over periods on June 15, 17, 18, and 20. The record was confirmed by Mr. Alfred M. Bailey, who observed the male carrying food and singing on June 18. Details of the song are given in the above reference.—FRANK A. PITELKA, *Lyons, Illinois.*

Partial albinism in a Bronzed Grackle.—On May 30, 1938, in the suburbs of Oklahoma City, a Bronzed Grackle (*Quiscalus quiscula aeneus*) with conspicuous white tail-feathers was seen and the following day was collected. It was one of a large colony of nesting birds. On examination it was found that the three outer tail-feathers on each side were normal in appearance and in good condition, but the five intermediate ones were white. As nearly as can be determined the missing feather is the left-hand one of the central pair. The ends of the shafts of these white feathers are broken and the webs abraded, leaving the shaft almost bare in places. The specimen was presented to the Museum of Comparative Zoology at Cambridge.—J. WILL HARMON, 1532 N. W. 29 St., *Oklahoma City, Oklahoma.*

Eastern Evening Grosbeak at Harrisburg, Pennsylvania.—On February 9, 1939, I found a female Eastern Evening Grosbeak (*Hesperiphona vespertina vespertina*) in Wildwood Park here. It was eating maple samaras. This is a rare bird for this district. It was seen the next day by John F. Kob, Miss Clara Hershey and Mrs. J. C. Burkholder.—HAROLD B. WOOD, *Harrisburg, Pennsylvania.*

On a specimen of *Sporophila cinnamomea* (Lafresnaye).—While rearranging the Fringillidae in the collection of the Academy I discovered a specimen, evidently a male, of this interesting and excessively rare species (A. N. S. P. 10,746). Hellmayr states (Birds Amer., part 11: 224, footnote, 1938), that "aside from the type, whose present whereabouts are in doubt, the only specimens on record are three males obtained by Natterer near Porto do Rio Araguaya, Goyaz, and preserved in the Vienna Museum." The type from "prope Rio Grande," probably the Rio Grande in the State of Goyaz, Brazil, was in the collection of M. Charles Brelay, Bordeaux. It seems possible that the Academy's specimen, included in the Duc de Rivoli (Massena) collection, is either the type or a paratype of this interesting bird, although unfortunately there are no data accompanying the specimen other than the word 'Brazil.' The female is unknown.—JAMES BOND, *Academy of Natural Sciences, Philadelphia, Pennsylvania.*

Northern Sage Sparrow on the east slope of the Rockies in Colorado.—On the morning of March 25, 1939, I saw an unfamiliar sparrow flitting beside the Moraine Park road at Rocky Mountain National Park. By checking the characters directly with the description in Bailey's 'Handbook of the Birds of the Western

United States,' I was able to identify the bird as a Northern Sage Sparrow, *Amphispiza n. nevadensis*. Park Naturalist Raymond Gregg drove up beside me a few minutes later, and said that he had also seen the bird, and that it was the first record of the species for the Park. By an odd chance, four days later this bird was accidentally caught in an ordinary mouse-trap at about the same spot, at an elevation of 8,000 feet above sea level.

There have been a very few sight records of the species on the eastern side of the continental divide in Colorado, at Longmont, Boulder, Denver, and Littleton; but the only recorded specimen taken there was a male collected March 18, 1904, by Mr. Dille on his farm in Boulder (Auk, 26: 87, 1909). Therefore, this constitutes the second definite record for eastern Colorado, and the first for Rocky Mountain National Park. The specimen, a female, is preserved at the Colorado Museum of Natural History.—FRED MALLERY PACKARD, *National Park Service, Estes Park, Colorado*.

Three records from Autauga County, Alabama.—These observations, although long delayed, seem worthy of record, since two species are additions to the Alabama list.

EUROPEAN WOODCOCK, *Scolopax rusticola rusticola*.—On March 2, 1889, in an old field adjoining North Bear Swamp, near Autaugaville, after I had been trying for more than a week to kill a woodcock that was 'belching' and 'scaiping' on the ground, then rising and spiralling to a great height, I concealed myself near where one of the birds had alighted at twilight on three successive evenings. This time the bird alit within ten steps of me and squatted, moving its head nervously. I shot it at once, and noted the large head and the barring on the breast, like that of a male Bob-white. I had a copy of Wood's 'Natural History,' which contained a picture of the European Woodcock, and my bird looked exactly like the picture. At the time, not knowing there was more than one kind of woodcock, I supposed I had killed the American bird (*Philohela minor*). Since then, however, I have killed a dozen or more of the latter, and the contrast with my 1889 specimen became very prominent in my mind. All these had reddish-colored breasts without bars, and were smaller than the first one taken.

BLACK-HEADED GROSBEEK, *Hedymeles melanocephalus*.—On May 4, 1928, near Booth, Alabama, a male of the species in full plumage was watched for some time at a distance of forty feet. It alighted singing, faced me squarely for a few seconds, then turned its side to me and flew diagonally away, giving me a full view in bright sunshine. Notes made at the time are as follows: a narrow black band extended around the chin, taking up possibly one-fourth of the throat; the under parts appeared reddish yellow, extending far up on the throat, the line of demarcation sharply defined. Turning its side to me, I noted that the bill was like that of the Rose-breasted Grosbeak, but its color was a blackish gray. The wings were black, with a band of white and a spot or two of white, also. Turning its back to me, I noticed a little white about the base of the tail. As it flew away from me I noticed the reddish yellow bordering the black head.

SWALLOW-TAILED KITE, *Elanoides forficatus*.—Though formerly common, the Swallow-tailed Kite has been rare in Alabama for many years. Howell (Birds of Alabama, p. 129) recorded several individuals seen in the southern part of the State—the last a specimen shot at Hartford, Geneva County, January 26, 1921. I have lived in Autauga County for 65 years and in that period I have seen this kite only once—in March, 1889. I now wish to record the occurrence of a pair of the birds,

apparently nesting, in a patch of swampy woods near the Alabama River, about five miles southwest of Prattville. One of the birds was killed on June 8, 1939, by a misguided farmer, who, seeing the bird flying high over his house and swooping toward the ground, thought his chickens were in danger of being caught.—LEWIS S. GOLSAN, Prattville, Alabama.

Notes from Wisconsin.—HOLBOELL'S GREBE, *Colymbus grisegena holboelli*.—On the morning of May 19, 1937, Mr. Harold Axtell and Mr. Albert Brand, of Cornell University, stopped at Hope Lake, Jefferson County, and discovered a Holboell's Grebe. Later in the day, Prof. Arthur A. Allen, Mr. Brand and I observed the bird. It was a male and appeared to be in nearly full breeding plumage. The call was heard several times.

PIPING PLOVER, *Charadrius melodus*.—This species is rare inland from the Great Lakes. I took a male April 30, 1938. The bird, associated with other shorebirds, was on a dry mud bank in a marsh near Lake Barney, Dane County.

RICHARDSON'S OWL, *Cryptoglaux f. richardsoni*.—A mounted specimen of this species was observed in a collection at the State Game Farm, Poynette. The bird was stated to have been taken in the immediate vicinity and mounted by Mr. Karl W. Kahmann of Hayward. A letter received from Mr. Kahmann states that the mount was sold to the State Game Farm. "The bird was killed on December 26, 1933, is a male probably in the first year's plumage. It was taken near Stone Lake, Washburn County, Wisconsin, within a stone's throw of the Sawyer County line." This specimen is mentioned by C. T. Black (Auk, 52: 451, 1935), but it seems advisable to record its present location in order to avoid future error.—A. W. SCHORGER, 168 North Prospect Ave., Madison, Wisconsin.

Birds that feed on Russian olive.—The enormous number of plants of the introduced Russian olive (*Elaeagnus angustifolia* L.) being used by a number of federal and state agencies throughout the Great Plains and adjacent territory in shelterbelt plantings for erosion control, and directly in wildlife plantings, makes it seem worth while to take stock of the value of this species to wildlife.

There is one published observation on the use of the Russian olive by birds. This record is for the Bohemian Waxwing (Stephens, T. C., Proc. Iowa Acad. Sci., 24: 245-248, 1917). For additional records I am indebted to Verne E. Davison, Adrian C. Fox, and Hal Miller of the U. S. Soil Conservation Service, Logan Bennett and Tom Murray of the U. S. Bureau of Biological Survey, and Neil W. Hosley, formerly of Harvard Forest, Petersham, Massachusetts. These men have made the observations credited to them below over a period of a few years in the States indicated, and have either orally or by letter communicated them to the undersigned who has been collecting such records for several years. The Section of Food Habits of the Biological Survey has also supplied two of the records.

Some of the following records lack exact dates, but all are otherwise accurate observations:—

EASTERN ROBIN, Bennett, Ames, Iowa, 1937.

WESTERN ROBIN, Miller, Pullman, Washington, fall 1937.

RING-NECKED PHEASANT, Davison, 1937 (stomach analysis showing 6.2 per cent of February food of sixteen birds in Beadle Co., N. D., to be Russian olive fruits); Miller, Pullman, Washington, 1937; Biological Survey files.

SHARP-TAILED GROUSE, Hosley, unpublished report, 1935; Biological Survey files.

CEDAR WAXWING, Fox, Park River, North Dakota, May 27, 1937.

HUNGARIAN PARTRIDGE, Murray, Boise, Idaho, 1937; Miller, Pullman, Washington, 1937.

BOB-WHITE, Murray, 1937.

WESTERN EVENING GROSBEEK, Van Dersal, Lewiston, Idaho, October 13, 1937;
Miller, Pullman, Washington, 1937.

VALLEY QUAIL, Murray, 1937.

In addition to these records wherein identification of both bird and plant have been made, Hosley's unpublished report lists "songbirds" as feeding upon the drupes. Also Leopold has written that grosbeaks use them; and both Hal Miller and Tom Murray have spoken of their use by finches of some kind. Hal Miller has also seen waxwings feeding on them.

The author has been collecting material of this sort for some time in an endeavor to accumulate records to assist in selecting vegetation of greatest possible value to wildlife for use in erosion-control plantings. Additional records of the same or different birds, or mammals, will be welcomed.—WILLIAM R. VAN DERSAL, *U. S. Soil Conservation Service, Washington, D. C.*

RECENT LITERATURE

'The Handbook of British Birds,' Vol. 3.—The third volume¹ of this splendid work follows promptly on the issue of the second (previously noticed in 'The Auk'). It comprises the British Falconiformes, Ciconiiformes and Anseriformes, of which at least the first and the last are groups of especial interest to sportsmen and ornithologists alike. In all, some ninety forms are included as entitled to unquestioned place on the British list, and of these thirty-seven or less than half are species confined to the Old World, while no less than forty-four are represented in North America either by the same forms or by closely related races. The remaining nine are North American species that occur as stragglers in the British Isles.

As in the two preceding volumes, the technical characters are given for the different orders, families and genera, while the subject matter following under each species is compactly arranged under the heads of habitat, field-characters and general habits, voice, display and posturing, breeding, food, distribution in British Isles, and abroad; then follows a precise and detailed description of the various plumages with emphasis on critical points, concluded by a paragraph on characters and allied forms. In presenting these accounts the authors have drawn freely on published sources covering the habits and distribution in both Europe and America, so as to give as nearly as possible a complete outline of the biology and characters of each species.

The well-executed plates in color form a special feature since not only is the series of smaller figures (four pictures to a plate) continued, but all the British species of geese are shown in color (two pictures to a plate) from paintings specially prepared for this work by Peter Scott, with an additional double plate in black and white by J. C. Harrison, showing the male and female of nineteen species of ducks in flight to illustrate their field marks. Another unique feature consists in four plates from photographs showing samples of typical down feathers from nests of geese and ducks, as an aid in the identification of nests. Other plates and numerous text-figures illustrate various details of distinction between allied forms. Separate indexes are given for English and Latin names.

A new point in nomenclature is that the Pink-footed Goose, which breeds in East Greenland, is now made a subspecies, *Anser fabalis brachyrhynchus*, of the Bean Goose. The Osprey is placed in a family by itself, after critical discussion of its peculiar characters. Further, in a note following the Introduction, it is shown that *Martula*, used in the second volume for the House Martin, must after all be considered a synonym of *Riparia*, and give place to *Delichon*.

In no other single volume is such a wealth of authentic and up to date information to be found concerning the habits and characters of the species treated. It should prove a standard work for frequent consultation by ornithologists on both sides of the Atlantic.—G. M. ALLEN.

Lockley's 'I Know an Island.'—What is it about an island that so strongly appeals to those of our race? Is it perhaps a desire for a bit of solitude where birds are more than people? Or may it be that the limits of the known world become reduced to a size that we can compass, 'since our hearts are small'? In this attractive volume² the author has given us a vivid glimpse of some of the islands of the Welsh

¹ The Handbook of British Birds | Vol. III (Hawks to Ducks). By H. F. Witherby, Rev. F. C. R. Jourdain, Norman F. Ticehurst and Bernard W. Tucker. 8vo, x + 387 pp., 39 pls., 46 text-figs., 7 maps, June 1939; H. F. & G. Witherby Ltd., 326 High Holborn, London W. C. 1. Price 25 shillings.

² Lockley, R. M. I Know an Island. 8vo, 300 pp., illustr., map, 1939; D. Appleton-Century Co., New York and London. \$3.00.

and Irish coasts, takes us on a visit to Heligoland, and leads us still farther on to the Orkneys, the Shetlands, the Faeroes, and even to the Westmann Islands off the south of Iceland. Inspired by a love for the rugged beauty of these outlying rocks and especially for their multitudes of seabirds, he selected the island of Skokholm off the coast of Wales as an abiding place where, surrounded by these wild inhabitants, he might form their closer acquaintance and gradually extend his journeys to neighboring havens. As an ornithologist the author is already well known for his work at Skokholm, where in 1934 he and his wife were hosts to the International Ornithological Congress. In this book, however, the emphasis is more on the general aspects of life on the contrasting islands, their individuality, their few and sturdy inhabitants, the swarming rabbits, the myriads of puffins, gulls, and shearwaters, the fishing and the seals. Yet there is much of incidental value on the birds. It appears that the Black-backed Gulls regularly attack and devour such large birds as puffins. The gannetry on the neighboring Grassholm is described. On some of the isles, the Manx Shearwaters compete with the rabbits for nesting burrows. On the island of North Ronaldshay the local small breed of sheep prefer seaweed to clover and the lambs when first born in May are often carried off alive by the Black-backed Gulls. Fulmars are developing interesting relations with their competitors and in the Faeroes have so increased of late years that they have driven out from some of the nesting cliffs the more edible and therefore more valuable guillemots and razorbills. For the islanders, who depend much on the seabirds for food, reckon the Fulmar as not worth eating except under necessity, for its flesh is as dry and tasteless as paper.

Here is a sympathetic and entertainingly told account of these islands that to most of us are merely names, yet teem with life and breed a race of simple, hardy people who prefer to live in freedom and wrest a bare existence from the sea and the land. The many illustrations enhance the description and give one a new interest in these isles of the North Atlantic. The lack of an index, however, at times makes it difficult for the reader to find the many interesting notes on birds that occur in the accounts of the various localities.—G. M. ALLEN.

Robinson and Chasen's 'Birds of the Malay Peninsula.'—The fourth volume of this series, begun in 1927 by the late H. C. Robinson, now appears under the authorship of his collaborator, Mr. Chasen, and fully sustains the excellence of the three previous volumes of the series. It was Robinson's plan to prepare a bird manual for the use of amateurs in Malaya, rather than for museum workers abroad, in the hope of arousing a greater interest in birds throughout that country. To this end he projected five volumes, each of which should cover the birds of a particular type of country so that a resident in a given area might more easily become acquainted with the avifauna of his special neighborhood. The first volume, issued in 1927, therefore treated of 'The Common Birds'; the second (1928) included 'The Birds of the Hill Stations'; the third (1936) treated of 'Sporting Birds, Birds of the Shore and Estuaries'; while the fourth¹ here noticed covers 'Birds of the Low-country Jungle and Scrub.' The author, whose experience in charge of the splendid bird collection at the Raffles Museum, has given him unrivalled opportunities for studying and collecting Malayan birds, has carried on the work in accord with Robinson's original plan, and while admitting that this method of treatment is open

¹ Chasen, Frederick N. *The Birds of the Malay Peninsula: a general account of the birds inhabiting the region from the Isthmus of Kra to Singapore with the adjacent islands* | Volume IV: *The birds of the low-country | jungle and scrub* | (with a notice of all species occurring in the lowlands) | large 8vo, xxvi + 487 pp., 25 col. pls., map, May 1939; H. F. & G. Witherby Ltd., 326 High Holborn, London W. C. 1. Price 35 shillings.

to some criticism and may involve occasional repetition or the inclusion of the same species in different volumes, nevertheless is convinced that the original choice has proved a practical one, for as a result of the interest aroused locally by the first volume, more has been added to the knowledge of life histories in the succeeding decade than in the previous fifty years.

The opening chapter is an abridged account of the geography of the Malay peninsula based on that by Robinson in the first volume, and is accompanied by a useful map. The following 419 pages take up in systematic sequence the jungle birds, which except for a finfoot and a grebe, birds of prey and hornbills, comprise a host of smaller species, barbets, broadbills, pittas, cuckoo-shrikes, bulbuls, babblers, thrushes, white-eyes and many others. The special method of treatment brings vividly before one the wealth and variety of birds of the denser growth in the eastern tropics, some of dull, others of strikingly brilliant and variegated plumage, making this in many ways the most interesting of the four volumes. For each species the author provides, in addition to the Latin name, a formal English one, a helpful feature for the amateur as well as the professional naturalist. A diagnosis and a description of plumage then follow, with a brief statement of range in the region and outside of it, and finally a short paragraph on nesting and one on characteristic habits. Keys are provided with each of the major groups, while in an appendix are a key and summary descriptions of the waterbirds included in the preceding volume. The twenty-five beautiful colored plates by Grönvold depict nearly twice that number of species and add greatly to one's appreciation of the variety and significance of color in birds of this habitat.

Among many interesting notes are occasional longer digressions, such as those on the plumage changes of sunbirds, some of which, the author points out, show in the male a post-nuptial dress like that of the female, to be followed in 'spring' by a complete molt to the characteristic brilliant breeding dress. There are also some valuable comparative notes on the relation of the feeding habits of these nectar-sippers to the types of flowers on which they feed.

These splendid volumes should prove a useful and stimulating preliminary to a series of later volumes planned to deal more especially with the life histories of the birds of Malaya, and will prove helpful to a far wider circle of ornithologists than those for whom they were specially written.—G. M. ALLEN.

Taverner's 'Birds of Canada' has been prepared with the object of providing in a single volume¹ a handbook covering the entire avifauna of Canada for the purpose of stimulating an interest both aesthetic and practical in the study of Canadian birds. The author's own familiarity with northern birds insures a thorough treatment and his wide experience in the field has given him an appreciation of the sort of facts that the less expert will find helpful. The introductory chapter explains the scope and method of the book, with sections on classification and geographic distribution, migration and protection. Following a chapter giving a list of important reference books and of papers covering special regions, is an illustrated key to the obvious characters whereby any Canadian bird may be identified. A strictly dichotomous key might have been easier to follow, with alternative choices. For example, under birds with "Feet fully webbed; A, toes four," we find as further subdivisions, "a, tarsus flattened" leading to loons, while under the alternatives "b" and "c," nothing further is said of the tarsus, but "b" gives characters of wing and tail,

¹ Taverner, P. A. *Birds of Canada*. 8vo, 445 pp., 173 plates in color, 488 black and white illustrations, 1938; Musson Book Co., Toronto, Canada; and David McKay Co., 604 South Washington Square, Philadelphia, Pennsylvania. \$4.00.

while "c" is concerned with the webbing of the feet. However, a little familiarity with the method will doubtless remove such difficulties. Under each of the species, taken up in the A. O. U. 'Check-list' order, are given the official vernacular name, followed by other names if any, then the name used by French-speaking people, the Latin name, then the distinctive characters, field marks, nesting and distribution in small type, with a brief account of the economic status or characteristic habits in larger print. It is thus a guide and handbook rather than an exhaustive treatise, yet contains a vast amount of useful information packed into small compass.

In the treatment of wide-ranging species with local representative forms, the author adopts the logical point of view that too great emphasis upon subspecific distinctions tends to obscure broader relationships of value. Thus in writing of the Raven or the Magpie, the range is given so as to include the distribution in both old and new worlds, followed by a special paragraph mentioning the subspecies and defining their general areas. Migration dates might have been useful, but the subject is dismissed in two pages of the introduction. Nevertheless in a book of this type one might have expected to find in the case of the more-northern breeders some indication of the times of their coming and going, but evidently this was outside the scope attempted. The many colored plates by Allan Brooks and F. C. Hennessey illustrate a large percentage of the birds treated, but especially helpful are the abundant text-figures in black and white, the work of the author himself, which show minor distinctive points and provide an unusually valuable aid for field identification. In addition to an exhaustive index of English and Latin names, there is a special index to the French vernacular names, and one to the A. O. U. numbers. The book is thus far more than a mere combination of the author's previous two works, covering respectively the birds of eastern and western Canada, but a thorough and well-illustrated guide to the identification in field and laboratory, of all the Canadian species, with helpful indications of other points of major interest in their study. It might conceivably form an introductory volume to a future one in which the northern birds would be treated from a life-history point of view.—G. M. ALLEN.

Lincoln's 'Migration of American Birds,' the latest addition to Doubleday's well-known 'Nature Library,' is a welcome contribution¹ to the abundant literature on this subject, providing not only a well-written summary of the general aspects of bird migration, but more important still, a large amount of new matter derived from the author's own investigations in the field and his study of the voluminous migration data now accumulated in the files of the United States Bureau of Biological Survey, particularly those resulting from extensive banding operations in the last decade or more.

Opening chapters sketch again a brief history of the older beliefs and theories of migration and the development of our knowledge on the subject. The causes of migration are still, the author points out, largely unsolved, but at least some of its advantages are obvious, while the fact that nearly every species performs its journeys in a special way, indicates that these causes are likely to have been multiple and have developed responses to the particular needs of each. Food or its lack seems one of the most likely reasons for changes of location by populations of birds yet many species start forth while food is still abundant. There is thus some stimulus requisite for the individual bird in order to make it start on its migration. The nature of this

¹ Lincoln, Frederick C. *The Migration of American Birds*. 8vo, xii + 189 pp., 12 colored plates, 22 text illustrations, 1939: Doubleday, Doran and Co., New York City. Price \$4.00.

stimulus is regarded as probably physiological, due in spring to gonadal development; but what of the autumnal urge? No reference is made to the many experiments of European ornithologists as to the latter nor is the recent important paper of Baldwin and Kendeigh mentioned in which the suggestion is made that there may be a relation between the weight of a bird and an optimum temperature at different times of year inducing change of location. The suggestion that migration may have been brought about originally by the climate of the Ice Age does not, as the author hints, seem to carry the matter far enough into the past. We are still therefore forced to admit that "all theories thus far advanced to account for the origin of the migratory habit are subject to unanswered criticisms."

Succeeding chapters admirably sum up the method of migration, its times and its dangers, with illustrations drawn from data on North American species. The all too brief chapter on pelagic migration exposes our inadequate knowledge of the subject, but nevertheless might have provided a better account of what is known of the causes determining the distribution and movements of American seabirds. In considering "vagrant migration," those irregular mass movements of such birds as Snowy Owls, or crossbills, no clear distinction is made between what Heape terms 'emigration' as in the case of the owls, and 'nomadism' as illustrated by the crossbills, but these are finer points. The chapter on bird banding tells of this newer method of studying movements of individual birds and is largely devoted to the statement of cases of interesting recoveries drawn from a large variety of species. One might have wished for a fuller account of the important facts now brought out by the study of banding returns, but perhaps the time is not yet ripe for their presentation. The final chapters are devoted to a study of 'flyways' as the principal migration routes are now to be called, with interesting suggestion as to the method of their development.

Twelve full-page colored plates brighten up the volume, and are reproduced from the familiar Fuertes paintings for Eaton's 'Birds of New York.' More important as an aid in visualizing the vast extent of migratory movements are the twenty-two full-page maps on which routes and seasonal-distribution areas are plotted.

As a clear and readable presentation of the main important facts in the migration of North American birds, this book forms a notable addition to the list of works on natural history now available for the 'general reader'.—G. M. ALLEN.

Bent's 'Life histories of North American Woodpeckers' forms the twelfth volume¹ of this series of bulletins, begun twenty years ago. It treats of sixty-four species and subspecies, giving as in previous parts, a condensed account of the habits, distribution, nesting dates and egg measurements as well as a description of plumages and other facts of interest. A wide search through literature for important notes is supplemented by the personal observations of many collaborators, and the aid of the U. S. Biological Survey's immense files of data is acknowledged. While Mr. Bent has borne the main part of the work in preparation of these life histories, a few are contributed by others: that on the Ivory-billed Woodpecker by Arthur A. Allen, those on the Northern Downy Woodpecker and Yellow-bellied Sapsucker by Dr. W. M. Tyler, that on the Red-cockaded Woodpecker by Eugene E. Murphy, that on the Northern Pileated Woodpecker by B. H. Christy.

The woodpeckers form a remarkable group of birds, specialized for their peculiar mode of life to a degree that is reflected strongly in the many external traits, such as

¹ Bent, Arthur Cleveland. *Life histories of North American Woodpeckers*. Order Paper. Bull. U. S. Nat. Mus., no. 174, viii + 334 pp., 39 pls., 1939. Superintendent of Documents, Washington, D. C., price 50 cents.

bill structure, foot structure, tail feathers, gait, that characterize these birds. They have become adapted to strange ways of living and of feeding, some have turned anteaters, some seek fruits, others again may show cannibalistic traits, others make storehouses for nuts. In North America, north of Mexico there are, however, only ten genera with twenty-two species, of which some are widespread and become diversified into numerous subspecies, while others are represented by only a single form. One, the Guadeloupe Woodpecker, an island form, is now extinct, due to the restriction of its range and changes incident to human occupation. In reading through these well-written summaries of our present knowledge of American woodpeckers, one has the impression that there is still much to be learned concerning their more intimate habits. For example, the European ornithologists find that the male woodpecker of some species usually takes over nest duty at night, and there are individual differences in different pairs in the amount of parental care, of which apparently little or nothing seems to have been noticed by American observers. The extraordinary habit of making a roosting burrow for the winter in the case of some species should be further investigated. Evolution of the food-storing habit needs additional study. In this useful summary of Mr. Bent's, the reader will find much to stimulate interest and suggest the needs of more searching observation. Thirty-nine plates of half-tones reproduce some remarkable photographs of these birds, their nests and their haunts. The volume is well indexed and is accompanied by an extensive bibliography. It is a satisfaction to know that this series of bulletins is continuing steadily.—G. M. ALLEN.

Cottam, Martin and Uhler on duck foods.—Two recent bulletins¹ of the U. S. Biological Survey provide timely and important information concerning the food requirements of North American ducks based on the careful analysis of stomach contents from several thousands of ducks taken at representative points. Ducks are of high esthetic, recreational and economic importance, both directly through their habits and appearance and indirectly through the commercial value of the sporting goods and local trade which sportsmen bring. With the alarming decrease in the duck populations of the continent in recent years, it becomes a matter of concern to attempt to build up the stock to something like a former level in order that these interests may be maintained.

In the first of the bulletins, the food habits of the diving ducks are considered. Of these, the Redhead, Canvas-back, Ring-necked, Scaup, Ruddy and Masked Ducks are predominantly plant feeders, while the Golden-eyes, Bufflehead, Oldsquaw, Eider Ducks and Scoters are mainly animal feeders. The second of the bulletins makes further summary of some eight thousand analyses of stomach contents, from eleven species of shoal-water ducks and seven of diving ducks. The method of presentation is unusually clear. The United States and Canada are divided into eight major regions: eastern and western Canada, the Atlantic and the Pacific coasts, eastern and western United States, the lower Mississippi Valley and the Gulf coast. For each of these are listed in tabular form the principal food plants used by ducks in the order of their abundance in stomach contents, with Latin and English names, numerical representation, and volumetric percentages shown both by figures and by black lines in proper proportion; in addition a small map is given with each table to show the region to which it pertains. In the second part of the

¹ Cottam, Clarence. Food habits of North American diving ducks. Techn. Bull., U. S. Dept. Agric., no. 643, 140 pp., 10 pls., April 1939. Price 30 cents.

Martin, A. C., and Uhler, F. M. Food of game ducks in the United States and Canada. Techn. Bull., U. S. Dept. Agric., no. 634, 157 pp., 153 pls., March 1939. Price 40 cents.

paper, the food plants are taken up separately according to species, with brief paragraphs on food value, parts eaten, means of identification, and propagation, together with a small map giving the geographic range of each. Animal foods are briefly covered in less detail. A third section deals specially with methods of management and propagation of food plants, and physical factors detrimental or favorable to their growth. The greater part of the second bulletin is given over to a series of 152 half-tone plates reproducing photographs of the chief animals and plants mentioned. The two bulletins together present in condensed form an immense amount of information previously scattered in literature or not available in printed form, and should be of the greatest value not only to the ornithologist requiring to know what ducks feed upon, but also to the conservationist or owner of private preserves, who must have a knowledge of food requirements in order to attract or maintain duck populations on breeding or resting areas. In addition to the many plates in black and white, there are excellent colored plates of the inland diving ducks and the sea ducks by Allan Brooks in the first bulletin, and a colored frontispiece of the Pintail by Kalmbach in the second. Obtainable from the Superintendent of Documents, Washington, for a very nominal sum, these valuable papers cannot fail to prove of great interest and value.—G. M. ALLEN.

Pettingill's 'Laboratory and Field Manual of Ornithology.'—Designed as a laboratory notebook for an introductory college course in ornithology, this¹ forms a convenient guide as well to the gross anatomy of birds and to the identification of families. It is printed in clear multigraph style on typewriter-size sheets, hinged with spiral binding wire at the back, to lie open flat at any point. The foreword states as the general aim of the course outlined: (1) the intensive study of birds as a highly specialized vertebrate type; (2) to provide a basic knowledge with which to pursue advanced work in ornithology; and (3) to promote a keener appreciation of a delightful and enjoyable element of the living world.

The guide lists the requisite material to be provided by the teacher of such a course and offers directions for the student to follow. The external anatomy of a pigeon or an English Sparrow is then taken up in topical sequence and the various parts named, even to such obvious features as "the horizontal fissure called the *mouth*." Outline drawings to be labelled by the student accompany the text; or blanks, to be filled in with drawings, serve to impress such matters on the mind. The internal anatomy is treated in similar style with directions as to what should be looked for, compared or drawn, so that the entire gross structure is covered. Pages for drawings of bills and other characters are followed by a classificatory list of important orders and families with a key to the orders found in the United States and Canada. The student is expected to work out the major characters of 150 representative birds supplied as laboratory skins. Distribution and migration routes are discussed and there are maps to be filled in by the student. Part II, Field Studies, provides directions for the identification and record of habits of various birds seen in the field while the final pages give a useful bibliography of accessible works of reference.

Any student who has thoroughly mastered the subject matter and field work indicated should derive therefrom a good outline knowledge of the general structure of birds. The manual will prove suggestive and useful to all teachers and students in this field as a concise set of directions and guide to observation.—G. M. ALLEN.

¹ Pettingill, Olin Sewall, Jr. A laboratory and field manual of ornithology. 127 pp. (typewriter size), Burgess Publ. Co., 426 South 6th St., Minneapolis, Minnesota. \$1.70.

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OBITUARIES

SERGIUS ALEXANDROVICH BUTURLIN, an Honorary Fellow of the American Ornithologists' Union, died in Moscow, U. S. S. R., January 22, 1938, at the age of sixty-five. He was born in Montreux, Switzerland, September 22, 1872, but was educated and spent most of his life in Russia. He attended school at Simbirsk and later studied law in St. Petersburg, but so great was his interest in zoology that he devoted most of his active life to collecting in various parts of Russia and Siberia and working out the results of his observations. Before he was twenty, he collected in the Volga district, later in the Baltic provinces and in 1900-02 on the islands of Kolguev and Nova Zembla. In 1904-06 he was in charge of an expedition to the Kolyma River in northeastern Siberia, in 1909 he visited the Altai Steppes and in 1925 he made his last journey to the Chutotsk Peninsula.

As a result of this extensive field work he published a number of important papers on the taxonomy and distribution of Palaearctic birds, including 'The Birds of the Kolguev Island and Novaya Zemlya and the lower part of the Darna' (1901), 'The Birds of the Simbirsk Government' (1906), 'The Birds of the Yenisseisk district' (with Tugarmov, 1911), a series of papers on the birds of the Far East (1909-17) and a 'Complete Synopsis of the Birds of the U. S. S. R.' in three volumes. He also published papers on special groups, his discovery of the breeding grounds of the Rosy Gull (*Rhodostethia rosea*) and various subjects of zoology, hunting and geography. His bibliography is estimated to include about 2000 titles. In 1918, he joined the Zoological Museum of the University of Moscow where he devoted his time to ornithology and in 1924 gave his collection of Palaearctic birds to the Museum.

Buturlin was elected a Foreign Member of the British Ornithologists' Union in 1906, a Corresponding Fellow of the A. O. U. in 1907 and an Honorary Fellow in 1916. He was a pioneer in Russia in studying variation and described more than two hundred new forms of birds. At the time of his death he was not only one of the most prominent Russian ornithologists but one of the leading authorities on Palaearctic birds.—T. S. PALMER.

WILLIAM CABELL RIVES, 3d, a Life Member of the American Ornithologists' Union, died after a brief illness at his residence in Washington, D. C., December 17, 1938, less than a month before his eighty-ninth birthday. He was descended from a distinguished Virginia family which included Thomas Walker and William Cabell Rives of Castle Hill, Albemarle County. Dr. Rives was the son of William Cabell and Grace Winthrop Rives and was born in Paris, January 10, 1850, while his grandfather was serving as Minister to France. With unusual educational advantages, he graduated from Harvard in 1871, then from Corpus Christi College, Oxford, and later obtained his medical degree in Vienna. In 1876, he married Mary Rhinelanders Sears of Boston. After his return to America he spent some years in hospital work in Newport, Rhode Island, and New York, where he met Right Reverend Henry Y. Satterlee, first Bishop of Washington, and followed him to Washington in 1900. He soon became interested in the development of the Washington Cathedral to which he contributed liberally as well as to local organizations concerned with charitable work. It was said that he never learned how to ignore a human need.

Dr. Rives was elected an Associate of the Union at its third meeting in 1885 and a Member in 1901. His contributions to ornithology were confined chiefly to notes on the birds of Rhode Island and Virginia. In July 1884, he published a brief paper on the 'Birds of Newport, R. I.' and in 1901 his 'Catalogue of the Birds of the Virginias'

containing notes on 305 species. In the latter part of his life Dr. Rives suffered from deafness which interfered with his field work and curtailed his activities in various ways but he never lost his interest in birds, people or the organizations which claimed his chief attention. To the last he maintained his interest in the Union and its work.—T. S. PALMER.

REV. PUTNAM BURTON PEABODY, an Associate of the American Ornithologists' Union, died at the age of 81 at his home in Topeka, Kansas, October 8, 1937, and was buried at his birthplace in Wisconsin. Born in Alden, Polk Co., Wisconsin, July 28, 1856, the son of a pioneer Episcopalian missionary, he was the first white child born in that county. Most of his adult life was spent in Minnesota and Kansas. During the 'nineties he lived in Minnesota at Owatonna, Wilder, St. Vincent and Halleck; from 1903 to 1905 at Newcastle and Sundance, Wyoming; and then in northeastern Kansas where he resided during the latter part of his life: eighteen years at Blue Rapids and twelve at Topeka. These various places represent the field of his ornithological observations.

He was one of the pioneer bird students of Minnesota and Kansas and published many notes on birds observed in the regions where he lived. These notes, dealing mainly with nesting and the occurrence of the rarer species, appeared chiefly in 'The Oölogist,' and 'The Ornithologist and Oölogist' and some of them have been quoted in Bent's 'Life Histories of North American Birds' and other publications.

Peabody was an Associate of the Union from 1891 to 1900 and from 1903 until his death. His first note in 'The Auk' appeared in the volume for 1895. Beginning in 1894 he sent reports on bird migration to the U. S. Department of Agriculture which, in 1938, included his name in the Honor Roll of migration observers in recognition of his coöperation extending over a period of forty-three years.—T. S. PALMER.

WILLIAM DERRICK RICHARDSON, who became an Associate of the Union in 1917, died, January 14, 1936, at his home in Chicago. He had an active interest in ornithology and his photographs of natural objects, especially birds, were splendid achievements; they have been exhibited on the walls of the Chicago Camera Club, at art exhibits in London, Paris and Tokio and, on several occasions at meetings of the Union. For many years chief chemist for Swift & Co., he was a member of the American Chemical Society and the first editor of 'Industrial and Engineering Chemistry' of which he was one of the founders. The 'Chicago Chemical Bulletin,' February, 1936, says, "His star in 'American Men of Science' attests his scholarship more eloquently than could the pen of his chronicler."

He and Mrs. Richardson, a life member of the Union who survives him, spent much time at their cottage in the Indiana Dunes where Richardson was adept in locating, for the purpose of picture making, the nests of Horned Owls, Ruffed Grouse, hummingbirds and other species. His gull studies were especially beautiful. For several seasons he visited and camped on the islands north of Green Bay in order to get pictures of the Herring Gulls and Caspian Terns nesting there.

A grave and studious man, the outdoors inevitably brought out the joy that was in him. Swimming, skating, tree-climbing, camp-cooking—these were activities that gave him a large satisfaction. We who were permitted to take part in them with him shall not soon forget.—EDWARD R. FORD.

JOSEPH SIMONS, of Chicago, who became an Associate of the Union in 1929, died on April 29, 1935. He was born in Bristol, England, June 29, 1866. A lover of outdoor life, in early manhood he established a wilderness retreat in the Squaw Lake

region of northern Minnesota. To reach his camp it was necessary to pack in from Bena, then a thriving lumber town thirty miles away. Later the camp became a hand-wrought log mansion, built by neighboring Finlanders after the manner of their ancestors, a thousand years ago. Modern conveniences were installed and here lovers of the out-of-doors were welcomed. Mr. Simons' hospitality extended not only to the excellence of these accommodations but to a bountiful table, in preparing the chief dishes of which he took justifiable pride.

He was universally respected for his integrity, business acumen and lack of pretense. His neighbors of the wilderness, mostly Finns, held him in high regard. He traveled widely and made a large collection of photographs of remote scenes. His interest in photography resulted in his election to the presidency of the Chicago Camera Club. He was a sustaining member of the Inland Bird Banding Association and a collector of fine editions of ornithological books. Some of these were presented by his widow to the Chicago Academy of Sciences.

His Squaw Lake lands, 400 acres, are a wildlife sanctuary where nest the Connecticut Warbler, Nelson's Sparrow, Pileated Woodpecker and hundreds of Mallard and Teal.—EDWARD R. FORD.

CORRESPONDENCE

MORE NOMENCLATURE IN THE GENUS *Quiscalus*

To the Editor of 'The Auk':

In reply to Dr. Frank M. Chapman's friendly discussion (Auk, 56: 364-365, 1939) of the proper name for the Bronzed Grackle, let me say, first, that no one is more averse to useless shifting in the scientific names of our birds than the writer. Only in those instances where the case seems clear-cut and application of our rules of nomenclature demands it, has he personally proposed changes from existing status. His conclusion (see Wetmore, A., Proc. U. S. Nat. Mus., 86: 230-231, 1939) that the name *Quiscalus versicolor* Vieillot (Nouv. Diet. Hist. Nat., 28: 488, 1819) applies to the Bronzed Grackle and to no other bird, has been reached only after careful consideration of the facts that have presented themselves.

These facts primarily have concerned a specimen in the Muséum National d'Histoire Naturelle in Paris, a Bronzed Grackle mounted on a conventional perch, and marked on the bottom of the stand "Amérique Septentrionale, Ancien Cabinet, 5918, *Quiscalus versicolor* Vieill. Type." A small label on the front of the stand reads "*Quiscalus versicolor* (Vieill.), Type, Etats-Unis." and on the back of the T-perch is the number "356." This specimen I handled personally in May 1938, and so far as I could ascertain, it is the only specimen preserved that Vieillot might have had available when he wrote the description cited above. The only other *Quiscalus* of that period that I could find in the collection was another mounted bird bearing on the bottom of the stand the inscription "Etats-Unis, Charleston, M. Elliot, 1823, 5914, *Quiscalus versicolor* Vieil." On the back of the perch is the number "362." As the label indicates the date 1823, Vieillot could not have had this bird for examination in 1819. The bird marked as the type is an adult male Bronzed Grackle that from the slight wear evident on the ends of primaries and rectrices apparently was collected in late spring or early summer. It may be noted here that while Vieillot cites "*Gracula quiscula* Lath.," following his own name *Quiscalus versicolor*, he does not translate Latham's account, but evidently drew his description from a specimen, since his account is different from that of Latham.

No one has devoted more time to the grackles of the genus *Quiscalus* than Dr. Frank M. Chapman and I hesitate to disagree with him on detailed questions of the colors they present. But in the present instance, I must defend my own observation, which is that Vieillot's description, quoted by Dr. Chapman, applies to the specimen in the Paris Museum marked as Vieillot's type. While that type specimen is far away as I write these lines my notes made on it as I examined it are before me, and my remembrance of it is clear.

To check the matter further, also before me as I write is an adult male Bronzed Grackle taken May 12, 1938, at Waverly, Union County, Kentucky, not far from the Ohio River in the northwestern part of the State. This is a breeding bird in the slightly worn plumage of the early breeding season. It is representative of its group and is in no way peculiar.

The handsome coloration in the males of all of the races of the genus *Quiscalus* is due to the reflection of light from the structural features of the feathers. As I turn this specimen from Kentucky so that its feathers receive the light from varying angles I note in the plumage shades of blue, purple, violet and green—in other words the hues described by Vieillot in his bird more than one hundred and twenty years ago. I get the same color effects from other male Bronzed Grackles from various

regions in the Upper Mississippi Valley as I take them up and turn them in the light for examination.

On these grounds, unless definite proof to the contrary can be advanced, it has seemed to me necessary that we accept this labelled specimen as the type of *Quiscalus versicolor*. If we do not accept it, then many other current names in ornithological literature, based on specimens of similar status and widely used today, are unstable and in jeopardy. I heartily wish that I could follow Dr. Chapman's desire to believe Vieillot's name of uncertain application, but from present information it appears to me unavoidable to consider that it applies truly to the Bronzed Grackle.

ALEXANDER WETMORE

U. S. National Museum
Washington, D. C.

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*Museum of Comparative Zoology
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THE following resolution was passed at the annual meeting in Berkeley, California, in June: "Resolved that the Council authorize the Editor to announce in the October issue of 'The Auk' that claims for replacement of missing or defective copies of 'The Auk' will not be honored unless received by the Business Manager within six months of publication of the particular number involved. After six months have elapsed and no notice has been received by the Treasurer, members will pay the regular published sale price for copies of 'The Auk.' "

This resolution is to go into effect beginning with this issue of 'The Auk.'

ATTENTION is called to the fact that the Treasurer must follow the By-Laws and the rulings of the Council that members who are a year in arrears for dues are automatically dropped from the roll of membership. The A.O.U. will be glad to reinstate any member upon payment of back dues.

The mailing of 'The Auk' on January 1 would be greatly expedited if dues of members are paid by December 15. Subsequent mailings are a source of annoyance and inconvenience to members and of needless expense to the Union.

